CONSTRUCTION EXPERIENCE

AND

DRILLED SHAFT INSTALLATION PLAN

RENTON TO BELLEVUE, I-405 EXPANSION

RENTON TO BELLEVUE, WA

Submitted To:

Flatiron
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I-405, Renton to Bellevue Widening & and Express Toll Lanes Project

DOCUMENT REVIEW

- [x] APPROVED, NO EXCEPTION TAKEN
- [ ] APPROVED AS NOTED
- [ ] RESUBMIT, REVISE AS NOTED
- [ ] REVIEWED COMMENTS PROVIDED IF ANY

REVIEWED BY: Milan Radic, PE DATE: 11/16/21

Review is for general conformance with contract or design documents. Sole responsibility for correctness of dimensions, details, quantities, materials, and safety during fabrication and erection shall remain with the contractor

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SECTION A – DRILLED SHAFT FOUNDATIONS

SECTION B – CONTRACTOR'S EXPERIENCE REQUIREMENTS

SUB-ITEM (1): DRILLED SHAFT PROJECT EXPERIENCE

Please find a list of drilled shaft projects completed by Michels Corporation attached in **Tab 1**.

SUB-ITEM (2): ON-SITE SUPERVISOR

James Smith is the proposed Site Superintendent for the Drilled Shafts. Jarred Sedge is the proposed operator for the excavation crane. Resume for each of the above proposed personnel are attached in **Tab 2**.

SECTION C - SHAFT INSTALLATION PLAN

The Geotechnical Data Report provided in the contract documents was prepared by WSDOT dated December 4, 2018. The bore logs were completed at various locations along the Right of Way (ROW) of the project.

The site soils generally consist of very loose to very dense silts, sands, and gravels. While class-conscious in some locations, many of the soil layers are a combination of the descriptions above with very little influence of water in most shaft locations and depths.

SUB-ITEM (1): OVERALL CONSTRUCTION SEQUENCE

The general steps involved with the shaft construction are outlined below. Due to the soils represented in the Geotechnical Report, Michels intends to drill the sign shafts using Open Hole Drilling Methods. If required due to water infiltration, Michels will introduce slurry to maintain shaft wall stability.

Open Hole Excavation Steps:

1. Position the Drill rig on location and center the tooling in the correct location.
2. Begin excavation. Soil from within the shaft will be excavated with augers, digging buckets. Drill spoils to be deposited within swing radius of drill rig.
3. If required to maintain hole stability in the top 10' of soils, Michels will install a temporary top casing.
4. Michels will continue the shaft excavation until the correct tip of shaft elevation is achieved.
5. After shaft is drilled to depth, the shaft will be cleaned with a spin bottom.

6. Pick drilled shaft cage and place in hole to the correct top and bottom of cage elevation.

7. Place tremie to the bottom of shaft prior to starting concrete placement.

8. Place concrete from bottom of shaft to top of shaft elevation.

Slurry Shaft Excavation Steps:

1. Position the Drill rig on location and center the tooling in the correct location.

2. Begin excavation. Soil from within the shaft will be excavated with augers, digging buckets. Drill spoils to be deposited within swing radius of drill rig.

3. If required to maintain hole stability in the top 10' of soils, Michels will install a temporary top casing.

4. As the excavation continues, slurry will be added to the shaft as required to provide and maintain hole stability below the previously placed top casing.

5. Excavate drilled shaft to depth using slurry drilling. During Excavation, a dedicated slurry crewmember will ensure a proper slurry head is maintained throughout the construction of the shaft.

6. After shaft is drilled to depth, the shaft will be cleaned with a spin bottom.

7. Pick drilled shaft cage and place in hole to the correct top and bottom of cage elevation.

8. After cleaning the base of the shaft and completing sand content test along with sounding bottom of shaft with weighted tape is complete, the concrete will be placed by the tremie method.

9. As concrete is placed in the shaft, the tremie will remain 5' – 10' in the concrete through the duration of the pour.

10. Finish concrete pour to top of shaft location.

SUB-ITEM (2): EQUIPMENT LIST

The drilled shafts will be installed through a variety of soils in which promote open hole drilling or the use of slurry to maintain shaft stability. This NON-VIBRATORY method of drilled shaft construction reduces the potential for caving, bottom heave, and settlements. If hole stability is a concern, Michels will use drilling slurry to eliminate the potential for caving, heave, and settlement,

Drill Rig 1: Bauer BG-15 (for shafts 4' or smaller)

Drill Rig 2: Watson EX-130 (for shafts greater than 4')

Support Crane: Linkbelt TCC-500

SUB-ITEM (3): SHAFT EXCAVATION METHODS

SHAFT EXCAVATION METHODS – OPEN HOLE DRILLING

The drilled shaft for open hole excavation will advance using a top drive rotary drill rig. The drill tools are equipped with carbide teeth that can penetrate most obstructions. If necessary, Michels will also have a core barrel on site to aid in removing challenging obstructions. After broken, the remains of the obstruction will be removed from bottom of the shaft with the core barrel or the digging bucket.

As the excavation begins, Michels will dig the shaft approximately 5' prior to installing a temporary top casing to maintain hole stability. The top casing will be installed from grade to approximately 10' below grade. After the top casing is installed, Michels will continue to drill below the bottom of the temporary top casing. Drilling will be advanced while depositing drill spoils within swing radius of the drill rig. As the excavation continues, a drill oiler, tied off to a Deadman, will be sounding the bottom of hole to confirm drill depth and ensure the shaft is not over drilled.

The dense moist geological conditions will lend themselves beneficial to open hole drilling conditions for the sign shafts. As the excavation advances, a Michels drill oiler we observe the soils being conveyed to surface to ensure they are representative of what is shown in the geotechnical report and suitable for open hole drilling.

SHAFT EXCAVATION METHODS – SLURRY DRILLING

Drilled shafts that will be excavated using a slurry drilling method using a conventional top drive drill rig. As the excavation is advanced, slurry will be placed into the drilled shaft to maintain the stability of the shaft. The drill tools are equipped with carbide teeth that can penetrate most obstructions. If necessary, Michels will also have a core barrel on site to aid in removing challenging obstructions. After broken, the remains of the obstruction will be removed from bottom of the shaft with the core barrel or the digging bucket.

As the excavation advances, a designated crewmember will monitor the slurry level to ensure hole stability. This crewmember will be responsible for continuously filling the shaft with slurry as the excavation advances. Additionally, another crewmember will be in charge of ensuring the slurry at the baker tanks is of adequate viscosity and cleanliness as it is conveyed to the drilled shaft.

Michels will do it's very best to stop excavation at design tip elevation. To ensure a hard bottom, in a water head condition, Michels will perform a sand content test and sound bottom of shaft with a weighted tape, this will also be confirmed by an onsite inspector prior to

pouring. The pouring of a shaft will not occur until bottom of shaft is deemed sufficient. Michels will not use vibratory methods during shaft construction so liquefaction will not occur.

During the shaft excavation the drill spoils will be loaded directly into trucks a spoils box or ground adjacent to shaft for removal from site and disposal.

SUB-ITEM (4): METHODS TO ENSURE SHAFT STABILITY

OPEN HOLE DRILLING:

As stated above, Michels will only employ open hole drilling methods should the soil conditions be appropriate. If the soil conditions consist of medium to dense well graded soils with the absence of ground water, Michels will use open hole drilling methods.

To maintain top of hole stability, and prevent cave-ins, michels will use a temporary top casing that will extend approximately 10' below grade. Michels will then use open hole drilling methods to advance the shaft beyond the tip of the temporary casing. As the excavation advances, the drill oiler will monitor the drill spoils conveyed out of the shaft to ensure they are representative of what is shown in the geotech report.

Should Michels enter into soils not capable of standing freely without additional shaft stabilization, Michels will use slurry drilling methods to complete the remainder of the shaft. Michels will have slurry on site in case an unforeseen soil condition is encountered and need to flood the hole.

SLURRY DRILLING:

Shafts to be constructed in unstable soils will require polymer slurry to maintain hole stability during excavation and concrete placement. As the excavation advances, Michels will have a dedicated crewmember to ensure the proper amount of slurry is introduced into the shaft to maintain adequate head pressure. Additionally, Michels will have a certified slurry technician at the baker tank to monitor the cleanliness and viscosity of the slurry. Upon reaching tip elevation, Michels will measure the fine content to ensure there is less than 1 percent of suspended fines. If the slurry needs to be cleaned, Michels will floc the hole with approved flocculant.

After the shaft has been cleaned and ready to be poured, Michels will place approximately 10' of concrete in the bottom of the shaft prior to lifting the tremie. After 10' of concrete has been placed, the tremie will be raised at the same pace as the concrete. At no point will the tremie be pulled out of the concrete until final top of shaft elevation is achieved.

SUB-ITEM (5): SLURRY METHODS

For Slurry shafts, Michels will use Shore Pac Polymer Slurry by Cetco. Shore Pac Slurry has been recommended for this project due to its versatility and success in similar ground conditions to be found on site. Where Michels will use slurry drilling methods, it is expected to find, gravels, sands, and silts. Shore Pac is an environmentally slurry and readily recycled for the use on subsequent shafts. Additional information about Shore Pac can be referenced on **Tab 2**.

During slurry drilling operations, Michels will have a certified slurry technician monitoring the viscosity and cleanliness of the slurry. When using slurry on site, it is Michel's intention to mix the slurry in a baker tank prior to deploying in the shaft. Due to the geotechnical conditions found on site, it is estimated the viscosity of the slurry to be used on site will be 100-130 seconds per quart. This is monitored in all outgoing tanks during drilling operations.

As the excavation advances, Michels will have a dedicated employee that will monitor the level of slurry inside the drilled shaft. This employee will communicate directly with the driller and the slurry technician at the tank farm. Slurry will be continuously added during the excavation until tip of shaft elevation is achieved.

After the drilled shaft has been cleaned, concrete placement will commence. During concrete placement, Michels will pump the used slurry back to the tank farm to settle and be recycled for other shafts. This slurry will be recycled until it is no longer suitable to use.

Once the slurry is dead (lost viscosity), Michels will kill the PH level using soda ash. Once the PH level is within a tolerable range, and suspended particles have dropped out of the water, the drill water will be pumped to a discharge point provided by others.

SUB-ITEM (6): QUALITY CONTROL PLAN FOR SLURRY

The Michels Slurry technician on site is in charge of the quality of the slurry pumped in and out of the drilled shafts. Water used to create slurry on site must be clean, low in chorine, and no grey water.

Tools on site to monitor slurry:

1. **Mud Density Weight** – 64 Lb/ft3
2. **Marsh Funnel** – Target Viscosity 100-130
3. **PH Strips** – 8.5-9.5
4. **Sand Content Test Kit** – Less than or equal to 1%

Each of these tools will be used to monitor new slurry being created in baker tanks, recycled slurry in baker tanks, and in the drilled shaft. Michels will also be using diaphragm water

pumps (screwsuckers) because they don't "chop" the slurry when conveyed to and from the shaft. This lends to a higher quality product with a longer lifespan.

SUB-ITEM (7): METHOD TO ELIMINATE VOIDS

Prior to the installation of the drilled shafts, the earthwork contractor will cut grade down to top of shaft elevation to eliminate voids at the top of shaft elevation. Should the top of shaft be below grade, a temporary CMP pipe will be installed by others to create a clean transition at the top of sign shaft.

SUB-ITEM (8): REINFORCING STEEL SHOP DRAWINGS

Reinforcing cage shop drawings, fabrication and supply are the responsibility of the General Contractor and shop drawings will be submitted by them under separate cover.

Reinforcing cages as specified in the Contract Documents are to be delivered to the jobsite pre-tied (or tied on-site, as working area permits) and placed by Michels into the individual drilled shaft after the shaft has been drilled to the final tip elevation.

Cages are to be properly cross-braced such that cage deformation does not occur during the lifting, handling and placement operation. The cages are to be properly rigged such that they can be lifted from a horizontal position to a vertical position without compromising the integrity of the cage and/or the hoisting/rigging equipment. Centralizing devices are tied to the vertical and/or spiral bars of the cages prior to hoisting of the cage.

During final placement of shaft cages 4 each nylon slings will be placed at equal spacing around the shaft change. The chains will be attached to a spreader bar held by the hook of the crane.

SUB-ITEM (9): CONCRETE PLACEMENT METHODS

After an individual shaft has been excavated to the designed depth and the base of the shaft has been cleaned; any fine materials suspended in the water (if excavated under water) will be removed from the bottom of the shaft. If water is present, a sand content test will be performed to test the water at both the bottom and at mid-height prior to the concrete placement operation commencing work.

Concrete is to be placed using a boom pump attached to a 4"-5" diameter tremie pipe (slick line) that extends to the full length of the shaft. A seal or plug (commonly referred to as a "pig" or "rabbit") is placed into the top of the tremie pipe. Concrete is then pumped through the tremie pipe continuously with a minimum of 10' of head maintained above the bottom of the tremie pipe. The high slump concrete will freely flow around the steel reinforcement and against the soil face filling any pockets or voids that exist. For this reason, and due to the properties of the high slump concrete vibrating of the concrete is not necessary in any portion of the shaft.

While the shaft is pumped with concrete from the bottom up, Michels will keep a 10' concrete head from top of concrete to bottom of tremie until top of shaft is achieved. This is to ensure proper concrete placement and that concrete completely flows around the drilled shaft cages and against the soil face.

The Concrete Mix Design for the shafts is attached under **Tab 5**. This concrete mix has proven itself to be superior for construction of drilled shafts utilizing open hole and slurry drilling methods.

SUB-ITEM (10): UNPLANNED PAUSES OR STOPS AND EMERGENCY CONSTRUCTION JOINTS

For unplanned pauses or stops in work during the excavation operation, due to Michels employing an open hole and slurry drilling methods the following will take place:

1. Any drilled shaft will not be left for greater than 14 hours without a michels employee monitoring the hole. If required to sit greater than 14 hours, Michels will fill the shaft with slurry and monitor every 24 hours.

2. Should the shaft require Michels to be down greater than 48 hours due to an unplanned stop or emergency, Michels will backfill the shaft with a pumpable lean mix for a re-drill at a later date.

If a problem is encountered in the lower portion of the shaft during a concrete pour and a joint is required the concrete and re-steel will be removed from the shaft and the pour started over at a later date. If an emergency joint is required in the upper portion of the shaft and it is not practical to remove the concrete and re-steel then after the concrete has set, the surface of the concrete will be cleaned and the laitance removed and the concrete pour will be re-started.

SUB-ITEM (11): UNAUTHORIZED ENTRY DEVICES

During work hours, Michels will supervise its own personnel and activities in proximity of the shaft. During non-working hours, the General Contractor is responsible for securing the general work site. Any open shafts are to be covered and secured to prevent any unauthorized entry, usually with plywood or steel plate, then if required a piece of construction equipment or another heavy object placed on top to prohibit removal of the shaft cover.

SUB-ITEM (12): NONDESTRUCTIVE TESTING

There will be no nondestructive testing for the sign shafts.

MICHELS®
FOUNDATIONS

TAB 1

Reference/Experience List

MICHELS®

Drilled Shafts

Year	Owner/Customer	Contact	Phone Number	Project Name	Description / Foundation Type	Location	Contract Value	Status
2021	HP Civil	Josh Smith		Southern Oregon Seismic	Install 144 EA micropiles, 162 EA ground anchors and 12 EA - 72" DIA drilled shafts	Grants Pass, OR	$2,659,600.00	
2020	Strider	Kyle Gebhardt	360-380-1234	Thornton Overpass	Install 140 LF of 6' DIA shafts, 480 LF of 8' DIA shafts	Ferndale, WA	$798,500.00	
2020	Flatiron	Joseph Okelberry	425-420-9982	I-405 Renton to Bellevue	Install 246 EA drilled shafts ranging from 3' DIA to 8' DIA and 902 EA - 2.5' noise wall shafts	Renton, WA	$10,898.260.92	
2020	Atkinson			SR 3 Chico Creek	20,000 SF shotcrete install, soil nail, 22 EA 3.28' DIA, 8 EA 3.92" DIA Drill shaft install, 10 EA 6.56" DIA, 10 EA 8.2' DIA Drill Shafts	Bremerton,WA	$1,710,162.00	
2020	Walsh	Ben Mitchel		Union Street Ped Bridge	Install 15 EA micropiles and 8 EA drilled shafts ranging in DIA between 1.2M - 2.2M	Seattle, WA	$571,697.61	
2020	IMCO	Brett Himes	360-671-3936	Mukilteo Ferry Terminal Phase 2	Install 15 EA micropiles and 8 EA drilled shafts ranging in DIA between 1.2M - 2.2M	Mukilteo, WA	$165,206.00	
2020	Kiewit	Wes Renton	808-753-0406	Federal Way Link Ext	2.5' , 3.0", 4.92', 8.2' 9.19', 9.84', 11.25' DIA shafts, shaft spoil removal, and top casings	Federal Way, WA	$17,996,456.00	
2020	RL Wadsworth	Jon Lowe	801-553-1661	Porter Rockwell	Install 4 EA - 2.5M shafts	Draper, UT	$595,176.00	
2020	Granite/RLW	Derek Harames	801-533-1661	US-89 to I-84	Install 32 EA drilled shafts ranging from 1M DIA - 2M DIA	Layton, UT	$851,162.00	
2020	Wadsworth Bros	Linn Bogart	435-218-3948	BBP Yellowstone	236 EA 6' DIA, 562 EA 10' DIA drilled shaft, concrete and 10 EA themral integrity	Billings, MT	$1,571,399.00	
2020	Turner	Matt Bystedt	206-391-9997	1400 Madison	Install 61 EA soldier piles, 4,485 SF of lagging, 9 EA - 1.5M drilled shafts and 25 EA - 1M drilled shafts	Seattle, WA	$1,092,801.00	
2020	Sletten	Russell Robertson	406-868-7429	Higgins Ave	Install 1 EA -3' DIA drilled shaft and 9 EA - 4' DIA drilled shaft	Missoula, MT	$248,388.00	
2020	Selland	James Flowers	509-881-0339	Easton Hill	Install 10 EA - 4' DIA drilled shafts	Easton, WA	$400,623.00	
2020	Garco Construction	Tim Hutton	509-535-4688	Spokane River Bridge Trent Ave	Secant Piles and Drilled Shafts (8 & 10' dia)	Spokane, WA	$1,419,200.00	
2020	Hamilton Construction	Joe Hampton	541-746-2426	OR38 Umpqua River Bridge	Permanent Shoring and Drilled Shafts (8' dia)	Scottsburg, OR	$2,450,000.00	
2020	Highmark	John Harris	360-829-5189	Issaquah Fall City Road	Install 6 EA - 2.5M DIA and 6 EA - 3M DIA drilled shafts and 302' slip casing	Issaquah, WA	$841,527.00	
2020	Halme	Seth Ritter	509-725-4200	BNSF Realignment	Install 8 EA - 3' and 32 EA - 4' DIA drilled shafts	Spokane, WA	$798,293.30	
2019	Granite	Vance Aeschleman	425-508-6002	Waterfront Seattle Alaskan Way	31 EA between 1.2M, 2M, 2.8M and 3M DIA drilled shafts	Seattle, WA	$2,821,923.00	
2019	Granite	Blake Ambler	425-754-2235	East of Elgin Clifton	4 EA - 2M DIA drilled shafts	Pierce County, WA	$405,096.00	
2019	IMCO	C Masek	425-452-6800	Mountains to Sound	2 EA -1.2M and 4 EA - 2.5M DIA drilled shafts, 182 soldier piles, 243 DCP tiebacks and 22,545 SF lagging	Bellevue, WA	$2,611,000.00	
2019	Mortenson	Tony Munoff	425-497-7199	Citizen M	24 EA - 1.2M drilled shafts and 37 EA well point dewatering well	Seattle, WA	$631,577.00	
2019	SWK	Landon Lovingfoss	503-381-1704	Redmond Link Extension	Drilled shafts ranging from 10 EA - 4' DIA, 15 EA - 5' DIA, 5 EA - 6' DIA 20 EA - 8' DIA, 22 EA - 9' DIA and 2 EA - 10' DIA and installation of permanent casing	Redmond, WA	$7,151,242.00	
2019	Quigg Brothers	Ben Jones	360-533-1530	West Jefferson County	Install drilled shafts ranging from 4 EA - 1.5M DIA, 6 EA - 2M DIA, 4 EA - 2.5M DIA and 18 EA soldier piles	West Jefferson County, WA	$2,022,716.00	
2019	Interwest Construction	Jordan Ter Har	360-899-2013	Sultan River Bridge	7 EA - 2m DIA drilled shafts and installation of permanent casing	Sultan, WA	$375,822.00	
2019	Atkinson	Ryan Cearly	425-757-6549	I-5 Portland Ave SB	33 EA drilled shafts between 2M and 3M DIA, permanent/temporary/slip casing, 1,470 EA temporary soil nails and 35,578 SF of shotcrete	Tacoma, WA	$6,236,192.00	
2018	Michels Pipeline	Will Foster	253-332-2857	Tolt Bridge	Drill 8 caissons 24" DIA, 31.7' deep. Install casing through 15' of overburden and the water table into glacial material. Install cages and 4000 psi concrete in shafts.	Woodinville, WA	$138,295.00	

MICHELS®
FOUNDATIONS

TAB 2

MICHELS®

James Smith

Foreman

PROFESSIONAL EXPERIENCE

2019 – Present: **Foreman | Michels Corporation | Kent, WA**

Supervised construction projects from beginning to end and coordinated workers. Responsible for guiding staff, overseeing concrete installation, assigning tasks, preventing occupational hazards, and keeping records. Demonstrated technical skills, managerial abilities, attention to details, stamina, basic computer operation knowledge, and teamwork.

PROJECT PROFILES

Granite Construction | SR11 Padden Creek; Install 82 EA soldier piles, 212 ground anchors and 18,300 SF of lagging – Bellingham, WA

Tapani | PLW 1.3; Launch Pit Shoring and Receiving Shaft Shoring
– Beaverton, OR

IMCO | Mukilteo Ferry Terminal; 30" DIA Shafts, 14x120 LF Soldier Pile, 1180SF lagging
– Mukilteo, WA

Kiewit | Federal Way Link Ext; 2.5' , 3.0", 4.92', 8.2' 9.19', 9.84', 11.25' DIA shafts, shaft spoil removal, and top casings – Federal Way, WA

BNBuilders | Building X; Install 256 EA soldier piles, 159 EA tiebacks, 28,382 SF of lagging, 41,035 LF of rigid inclusions – Redmond, WA

Rodarte | S 180th Street; Well point well installation, discharge, removals & mobilization
– Auburn, WA

Holland Partners | Block 10; Temporary shoring (soldier piles / tiebacks / lagging)
– Vancouver, WA

Granite | 520 Trail; 144 total permanent soldier piles and lagging
– Redmond, WA

Garco Construction | Spokane River Bridge Trent Ave.; Secant Piles and Drilled Shafts (8 & 10' dia)
– Spokane, WA

SWK | Redmond Link Extension; Drilled shafts ranging from 10 EA - 4' DIA, 15 EA - 5' DIA, 5 EA - 6' DIA 20 EA - 8' DIA, 22 EA - 9' DIA and 2 EA - 10' DIA and installation of permanent casing
– Redmond, WA

IMCO | Mountains to Sound; 2 EA -1.2m and 4 EA - 2.5m DIA drilled shafts, 182 soldier piles, 243 DCP tiebacks and 22,545 SF lagging
– Bellevue, WA

Highmark | Issaquah Fall City Road; Install 6 EA - 2.5m DIA and 6 EA - 3M DIA drilled shafts and 302' slip casing
– Issaquah, WA

Granite | East of Elgin Clifton; 4 EA - 2m DIA drilled shafts
– Pierce County, WA

PROJECT PROFILES (continued)

Turner | Waverly (210- 8th); 97 EA soldier piles backfilled with concrete and lean mix, 303 EA tiebacks, 48 tie rods and 28,651 SF wood lagging
– Seattle, WA

Greystar | Arista U-Village; 463 Pressed permanent sheet piles, 114 temporary tiebacks, waler for sheet piles and tiebacks, 502 auger cast piles, removal or water system, 12 deep dewatering wells and 12 smart dewatering boxes to regulate flow rates
– Seattle, WA

Rodarte | Foothills Trail;

2019 Rodarte Foothills Trail 315 EA soil nail, 5,162.5 SF of 4" shotcrete

– Enumclaw, WA

Garco Construction | Cle Elum Gate; 114 EA soldier piles, 412 EA tiebacks and 34,650 SF of lagging
– Cle Elum, WA

Atkinson | i-5 Portland Ave SB; 33 EA drilled shafts between 2m and 3m DIAM, permanent/temporary/slip casing, 1,470 EA temporary soil nails and 35,578 SF of shotcrete
– Tacoma, WA

Walsh | Denny Way Substation; 391 Soldier Piles, 25,800 sq. ft. of lagging, and 130 tiebacks. – Seattle, WA

Graham | 1st Denny Lofts ; 13 Soldier piles, 26 tiebacks, 381 Soil nails, 31,000 sq. ft. shotcrete, and 8900 sq. ft. lagging. – Seattle, WA

City of Redmond | 360 Eastlink; 31- 30" DIA drilled shafts – Redmond, WA

Granite | College Way Marysville; 61 Tiebacks, 19,000 sq. ft. shotcrete placed. – Marysville, WA

Granite | 116th Overpass; 15 - 3.0 M shafts, 17 - 2.5 M shafts – Marysville, WA

Petra Construction | Assisted Living Apartments; 36 Soldier piles, soil nails, 9000 sq. ft. shotcrete placed. – Issaquah, WA

City of Issaquah | Road Improvement; 26 can levered soldier piles, 10,119 sq. ft. of lagging – Issaquah, WA

Absher | Annie Wright School for boys and gym; 9 under pinned Piles, 50 Soldier piles installed, 124 Tiebacks installed, and 28,756 sq. ft. lagging – Tacoma, WA

TRAINING & CERTIFICATIONS

- Pilot Escort - Washington State
- ACI certified Nozzleman (Vertical Only)
- Erosion and Sediment Control Lead Certified
- Trenching Excavating Competence
- Forklift Certification
- First Aid/CPR/AED Certification
- Flagger Certified
- Rigging Training
- Confined Space Entry Training

MICHELS®

Jared Sedge

Drill Operator

PROFESSIONAL EXPERIENCE

Drill Operator | Michels Corporation | Kent, WA

Duties include set up drill and support equipment so that foundation investigations can be accomplished by directing the moving of equipment onto the site; arranging equipment within work area. Operate drill rigs to obtain undisturbed soil samples and ground water information so that parameters can be selected for foundations design by choosing and mixing correct types and viscosity of drilling fluids. Responsible for daily inspection for the daily inspection reports and daily preventative maintenance of the equipment.

PROJECT PROFILES

Granite Construction | SR11 Padden Creek; Install 82 EA soldier piles, 212 ground anchors and 18,300 SF of lagging with permanent ground anchors
– Bellingham, WA

Tapani | PLW 1.3; Launch Pit Shoring and Receiving Shaft Shoring
– Beaverton, OR

Hamilton Construction | OR38 Umpqua River Bridge ; Permanent Shoring and Drilled Shafts (8' dia)
– Scottsburg, OR

SWK | Redmond Link Extension; Drilled shafts ranging from 10 EA - 4' DIA, 15 EA - 5' DIA, 5 EA - 6' DIA 20 EA - 8' DIA, 22 EA - 9' DIA and 2 EA - 10' DIA and installation of permanent casing
– Redmond, WA

Michels Pipeline | Jackson Prairie (Saturn Centaur Filter Separator Installation); Micropiles – Lewis County, WA

Rodarte | Foothills Trail; 315 EA soil nail, micro piles, and 5,162.5 SF of 4" shotcrete
– Enumclaw, WA

Turner | 1400 Madison; Install 61 EA soldier piles, 4,485 SF of lagging, 9 EA - 1.5M drilled shafts and 25 EA - 1M drilled shafts
– Seattle, WA

BNBuilders | Building X; Install 256 EA soldier piles, 159 EA tiebacks, 28,382 SF of lagging, 41,035 LF of rigid inclusions
– Redmond, WA

Holland Partners | Block 10; Install 45 EA soldier piles, 38 EA tiebacks and 5,415 SF of lagging
– Vancouver, WA

Granite | 520 Trail ; 144 total permanent soldier piles and lagging
– Redmond, WA

IMCO | Mountains to Sound; 2 EA -1.2M and 4 EA - 2.5M DIA drilled shafts, 182 soldier piles, 243 DCP tiebacks and 22,545 SF lagging with permanent ground anchors

– Bellevue, WA

PROJECT PROFILES (continued)

Granite | East of Elgin Clifton; 4 EA - 2M DIA drilled shafts
– Pierce County, WA

Kiewit | Federal Way Link Ext; 2.5' , 3.0", 4.92', 8.2' 9.19', 9.84', 11.25' DIA shafts, shaft spoil removal, and top casings
– Federal Way, WA

Turner | Waverly (210 8th); 97 EA soldier piles backfilled with concrete and lean mix, 303 EA tiebacks, 48 tie rods and 28,651 SF wood lagging
– Seattle, WA

GreyStar | Arista U-Village; 463 pressed permanent sheet piles, 114 temporary tiebacks, waler for sheet piles and tiebacks, 502 augercast piles, removal or waler system, 12 deep dewatering wells and 12 smart dewatering boxes to regulate flow rates
– Seattle, WA

Granite | Waterfront Seattle Alaskan Way; 31 EA between 1.2M, 2M, 2.8M and 3M DIA drilled shafts
– Seattle, WA

Garco Construction | Cle Elum Dam; 114 EA soldier piles, 412 EA tiebacks and 34,650 SF of lagging with permanent ground anchors

– Cle Elum , WA

Atkinson | I-5 Portland Ave SB; 33 EA drilled shafts between 2M and 3M DIA, permanent/temporary/slip casing, 1,470 EA temporary soil nails and 35,578 SF of shotcrete
– Tacoma, WA

TRAINING & CERTIFICATIONS

- OSHA 10-hour Construction
- Forklift Training Certification
- Confined Space Awareness
- Rigging Training
- First Aid/CPR/AED Certification

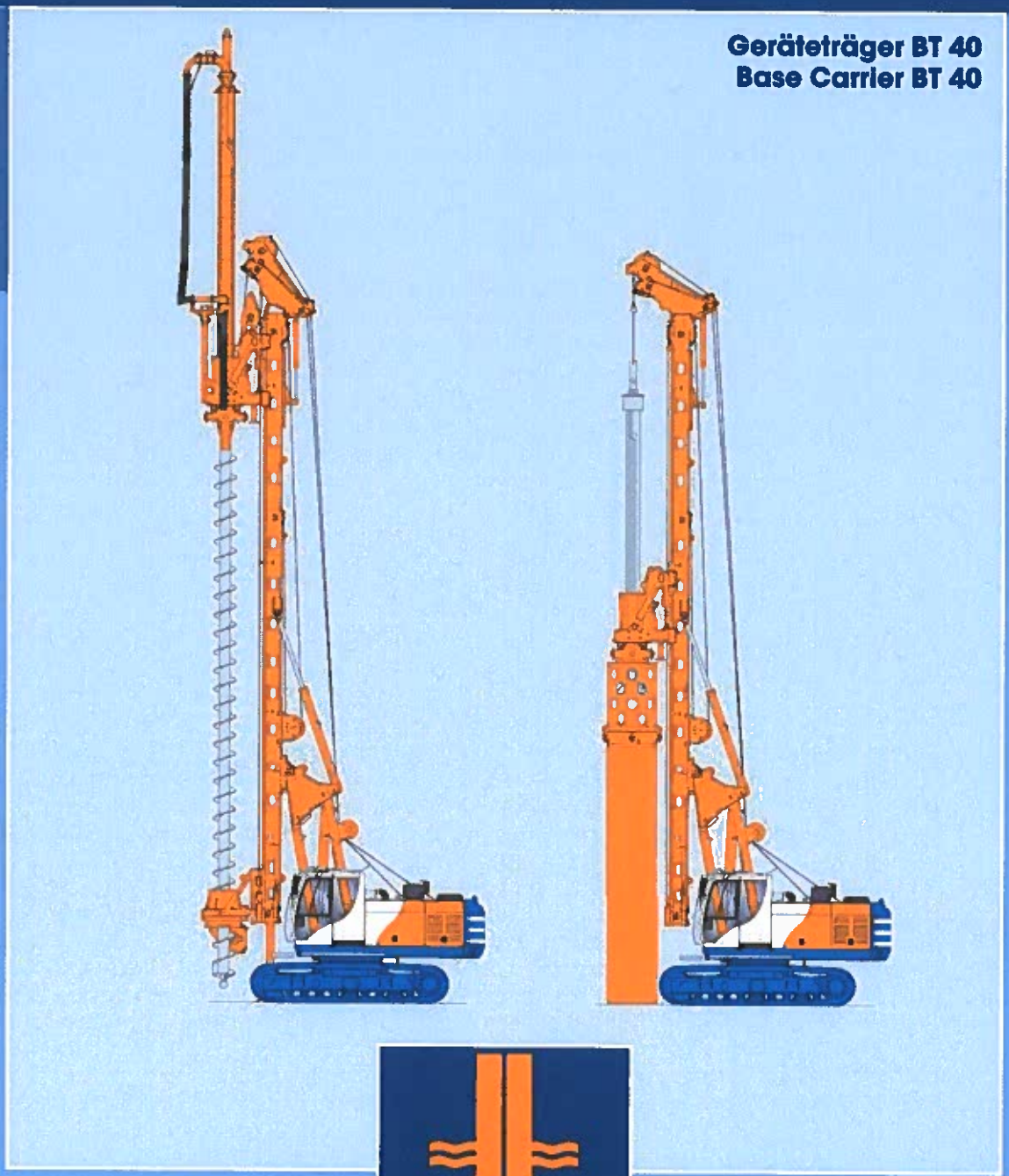
MICHELS®
FOUNDATIONS

TAB 3

BAUER BG 15 H

Großdrehbohrgerät
Rotary Drilling Rig

PremiumLine



BAUER

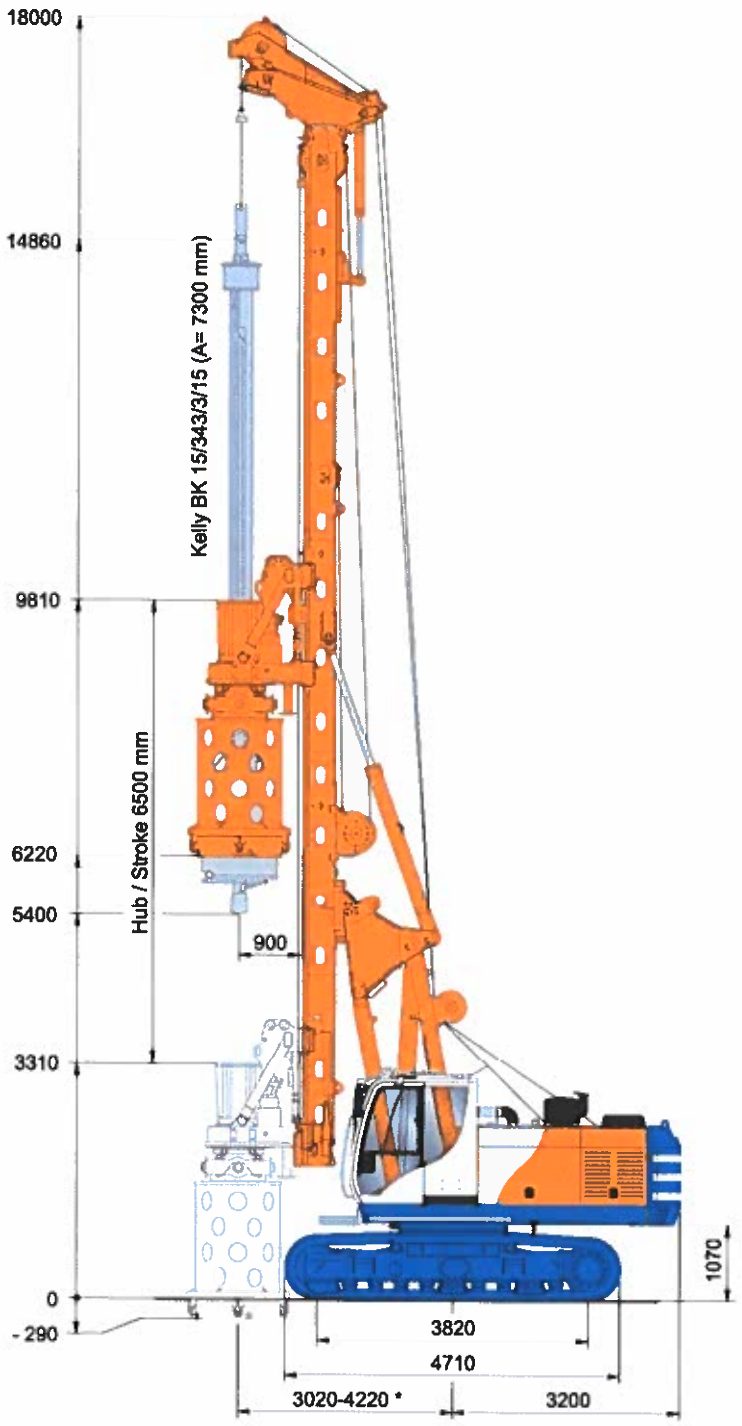
Abmessungen — Dimensions

Die **BG 15 H,** ein Gerät mit einem Einsatzgewicht von ca. 49 to dient zur Herstellung von

- verrohrten Bohrungen (Eindrehen des Bohrrohres mit dem Drehgetriebe oder mit angebauter Verrohrungsmaschine)
- unverrohrten, flüssigkeitsgestützten Bohrungen
- Bohrungen mit langer Hohlschnecke (SOB) - mit oder ohne Kellyverlängerung
- Sonderverfahren wie VdW-Bohren, Verdrängerbohrungen

The **BG 15 H** rotary drilling rig has an operating weight of approx. 49 to.
It is ideally suited for:

- Drilling cased boreholes (installation of casing by rotary drive or optionally by hydraulic oscillator – both are powered by the drilling rig)
- Drilling uncased deep boreholes that are stabilised by drilling fluids
- Drilling boreholes with long hollow stem augers (CFA system), with or without kelly extensions
- Special drilling systems, such as FOW piles, displacement piles



* Horizontalverschiebung (abhängig von der Bohrausrüstung)
horizontal mast reach (depending on the drilling equipment)

Bohrverfahren mit Serienausstattung:

Kellybohren (ohne Verrohrungsmaschine)

SOB-Verfahren (hydraulisch und elektrisch vorgerüstet)

FDP Verdrängerbohren (hydraulisch und elektrisch vorgerüstet)

Drilling processes with standard equipment:

Kelly drilling (without casing oscillator)

CFA drilling (pre-equipped with hydraulic and electric installations)

FDP Full-Displacement-Piling (pre-equipped with hydraulic and electric installations)

Technische Daten — Technical data

Gesamthöhe	**Overall height**	18.000 mm
Einsatzgewicht ca. (mit Kelly BK15/343/3/15)	**Operating weight** (approx.) (with kelly BK15/343/3/15)	49.000 kg
Drehantrieb	**Rotary drive**	**KDK 150 KL**
Drehmoment (nominal) bei 300 bar	Torque (nominal) at 300 bar	151 kNm
Drehzahl max	Speed of rotation (max.)	36 U/min (RPM)
Vorschubwinde	**Crowd winch**	
Druckkraft / Zugkraft (effektiv)	Crowd pressure push / pull (effective)	200 / 200 kN
Druckkraft / Zugkraft gemessen am Drehteller KDK	Crowd pressure / pull measured at the casing drive adapter on the rotary drive	150 / 150 kN
Hub (Kellysystem)	Stroke (kelly system)	6.500 mm
max. Schlittenhub	max. stroke of sledge	12.600 mm
Geschwindigkeit (ab/auf)	Speed (down/up)	7,0 / 7,0 m/min
Schnellgang (ab/auf)	Fast speed (down/up)	27 / 27 m/min
Hauptwinde	**Main winch**	
Windenklasse	Winch classification	M6 / L3 / T5
Zugkraft (1. Lage effektiv)	Single line pull (1st layer effective)	110 kN
Zugkraft (1. Lage nominal)	Single line pull (1st layer nominal)	140 kN
Seildurchmesser	Rope diameter	22 mm
Windengeschwindigkeit	Line speed max.	77 m/min
Hilfswinde	**Auxiliary winch**	
Windenklasse	Winch classification	M6 / L3 / T5
Zugkraft (1. Lage effektiv)	Single line pull (1st layer effective)	55 kN
Zugkraft (1. Lage nominal)	Single line pull (1st layer nominal)	70 kN
Seildurchmesser	Rope diameter	15 mm
Windengeschwindigkeit	Line speed (max.)	55 m/min
Mastneigung	**Mast inclination**	
nach hinten / vorne / quer	Backward / forward lateral	15° / 5° / +-5°

Bohrgerät

Serienausstattung
- Drehgetriebe KDK 150 KL (Konstantgetriebe)
- Hauptwinde mit hydraulischer Freilaufsteuerung
- Haupt- und Hilfswinde mit Spezialrillung
- Hubendschalter für Haupt- und Hilfswinde
- Wirbel für Hauptseil
- Vorschub schnell / langsam
- Schwenkbarer Anschlagpunkt für Haupt- und Hilfsseil
- Elektronisch kontrollierte Horizontalverschiebung

Zusatzausstattung
- Wirbel für Hilfsseil
- Mastabstützung
- Kellyablage
- obere Kellyführung für Kellystange BK 200/368
- Zusatzhilfswinde 20 kN
- Zentralschmierung
- Kameraanbau
- Betonierleitung
- Mechanische Anbauten für Automatikdrehteller
- Hydraulische Vorbereitung für Schneckenputzer
- Verrohrungsmaschinenanbau (max. BV 1300 L-03)
- Gittermastverlängerung (für HDI)
- Anbau für Tiefenrüttler TR 17

Drilling rig

Standard equipment
- Rotary drive KDK 150 KL (single gear drive)
- Main winch with hydraulically operated freewheeling
- Main and auxiliary winch with special grooving
- Hoist limit switch on main and auxiliary winches
- Swivel for main rope
- Crowd in fast or slow mode
- Pivoted anchor points for main and auxiliary ropes
- Electronic controlled horizontal mast reach

Optional equipment
- Swivel for auxiliary rope
- Mast support unit
- Kelly transport support
- Upper kelly guide for kelly bar BK 200/368
- Additional auxiliary winch 20 kN
- Central lubrication system
- Video camera attachment
- Concrete line
- Mechanical attachment for automatic casing drive adapter
- Hydraulic preparation for auger cleaner
- Oscillator attachment (max BV 1300 L-03)
- Lattice mast extension (for Jet Grouting)
- Attachment for depth vibrator TR 17

Technische Ausstattung — Technical equipment

Mess- und Steuerungstechnik

Serienausstattung

- Komfortpaket
  - Hauptwinde mit elektronischer Seilkraftmessung
  - Schlappseilabschaltung Hauptwinde
  - Funktion "Wirbel Aufstellen" Hauptwinde
  - Drehzahlmessung KDK
  - Anpressdruckregelung Kelly
  - Vorschubgeschwindigkeitssteuerung
  - Überlastschutz für Hauptseil
  - Überwachung Endschalter / Sensorik
- B-TRONIC 3.1 elektronisches Steuerungs-, Kontroll-,und Visualisierungssystem
- SPS Rechner für alle elektrisch angesteuerten Funktionen
- Integrierter Farbbildschirm zur Anzeige der Gerätedaten
- Anzeige von Fehlermeldungen in Klartext
- Notsteuerung Bohrgerät (Kernfunktionen)
- Mastneigungsmessung in x/y Richtung
- Mastautomatik (automatische Vertikalstellung)
- Hilfswinde mit hydraulischer Seilkraftmessung
- Tiefenmessung Hauptwinde
- Wegmessung Vorschubwinde
- Schockiereinrichtung für KDK
- Aufzeichnung und Fernübertragung der Betriebsdaten mit DTR-Modul

Zusatzausstattung

- Kellyvisualisierung für Kellystange BK 200/368
- Hilfswinde mit elektronischer Seilkraftmessung
- Abbohr- und Ziehassistent für 'Single Pass' Verfahren

Measuring and control equipment

Standard equipment

- Comfort package
  - Electronic load sensing on main rope
  - Rope slack prevention on main winch
  - Swivel alignment function on main winch
  - Speed measuring device on KDK
  - Crowd pressure control for kelly
  - Crowd speed control
  - Overload protection device on main rope
  - Automatic control of end switches and sensors
- B-TRONIC 3.1 Electronic monitoring-, control- and visualization- system
- PLC processor for all electrically actuated functions
- Integrated colour monitor for displaying machine operating data
- Display of fault messages as plain text
- Emergency mode of operation for drilling rig (core functions)
- Mast inclination measurement on x/y axes
- Automatic vertical alignment of mast
- Hydraulic load sensing on auxiliary rope
- Depth measuring device on main winch
- Distance measuring device on crowd winch
- Uni-directional impact function on KDK (for auger discharge)
- Recording and remote transmission of operating data with DTR-module

Optional equipment

- Kelly visualization for Kelly bar BK 200/368
- Electronic load sensing on auxiliary rope
- Crowd control assistance and tool extraction assistance for 'Single Pass' application

Trägergerät

Serienausstattung

- Motornotsteuerung
- Leerlaufautomatik (zur Verbrauchsoptimierung)
- Motordiagnostiksystem
- Diagnoseleiste für hydraulische Funktionen
- abnehmbarer Ballast
- Verzurraugen an Raupenträgern
- Aufstiegsleiter zum Oberwagen
- Bordbeleuchtungssatz
- Bordwerkzeugsatz
- Elektrische Betankungspumpe
- Moderne, ergonomische Fahrerkabine mit FOPS Standard
- Klimaanlage
- Radio mit CD, MP3, USB und Bluetooth-Freisprecheinrichtung
- Trittroste neben der Kabine
- Dachschutzgitter
- 2 Kameras zur Rückraumüberwachung

Zusatzausstattung

- Kompressor (1000 l/min Saugleistung)
- Generator 13 kVA
- Zusatzballast 2,25 t
- Bioölbefüllung
- Standheizung mit Zeitschaltuhr
- Trittroste oder Werkzeugkasten vor Kabine
- Frontschutzgitter
- Klimaautomatik (Climatronic)
- Kältepaket
- Absturzsicherung am Oberwagen
- Arbeitsscheinwerfer LED

Base carrier

Standard equipment

- Emergency mode of operation for engine
- Automatic idling mode (to optimise fuel consumption)
- Engine diagnostic system
- Diagnostic panel for hydraulic functions
- Removable counterweight
- Transport securing lugs on crawler units
- Access ladder on uppercarriage
- On-board lighting set
- On-board tool set
- Electric refuelling pump
- Modern, ergonomic operator's cab, FOPS compliant
- Air conditioning system
- Radio with CD, MP3, USB and Bluetooth c/w hands-free kit
- Catwalk on side of operator's cab
- Protective roof guard
- 2 cameras for rear area surveillance

Optional equipment

- Compressor (1000 l/min capacity)
- Electric generator 13 kVA
- Additional counterweight 2.25 to
- Bio-degradable oil
- Independent cab heater with clock timer
- Catwalk or tool box in front of cab
- Front screen guard
- Climatronic
- Arctic kit
- Guardrails upper level
- LED spotlights

Konstantgetriebe KDK 150 KL

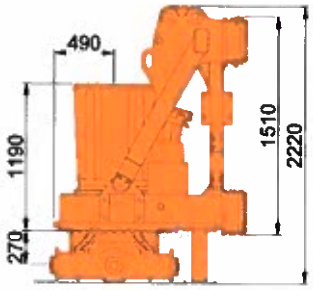
Single gear rotary drive KDK 150 KL

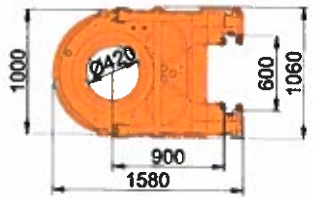
Serienausstattung

- Gleitleisten sind ohne Demontage des Drehgetriebes auswechselbar
- Auswechselbare Mitnehmerleisten
- Kardangelenk
- Hydraulische Verbindungen mit Schnellkupplungen
- 3 einstellbare Betriebsmodi: (siehe Diagranme)
- Transportstützen
- Hebegeschirr

Zusatzausstattung

- Kellyausrüstung KA 420/368





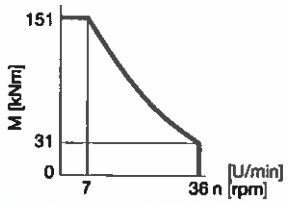
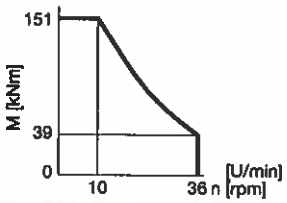
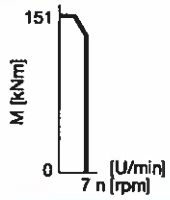
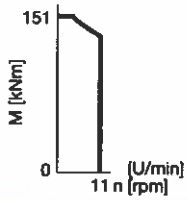
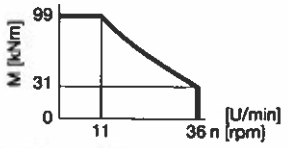
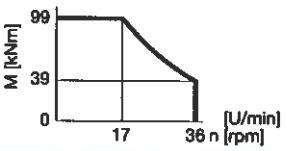
Gewicht mit Schlitten 3,7 t
Weight with sledge

Standard equipment

- Wear pads exchangeable without removal of rotary drive
- Exchangeable kelly drive keys
- Cardanic joint
- Quick-release couplers on hydraulic hoses
- 3 selectable modes of operation (refer to diagrams)
- Transport supports
- Slings gear for rotary drive

Optional equipment

- Kelly drive adapter KA 420/368

	KDK 150 KL 168 kW Motorleistung 168 kW engine power	KDK 150 KL 230 kW Motorleistung 230 kW engine power
1. Gang Standardbetrieb 1st gear standard mode		
1. Gang Einrichten und Felsbohren 1st gear Set up and rock drilling		
1. Gang M_D reduziert 1st gear M_D reduced		

Drehmoment nominal, Darstellung nicht maßstäblich
nominal torque values, not to scale

Trägergerät BT 40 — Base carrier BT 40

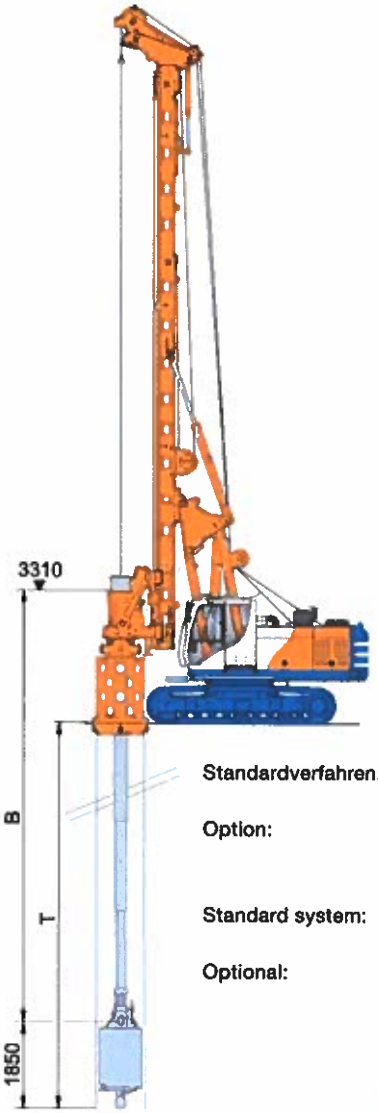
Das Trägergerät BT 40 wird von Bauer Maschinen geplant und gebaut. Der Motor und das Hydraulikaggregat sind längs eingebaut. Diese Bauweise gewährleistet optimale Luftführung, niedrige Transporthöhe und optimale Kühlleistung bis 40° Außentemperatur.

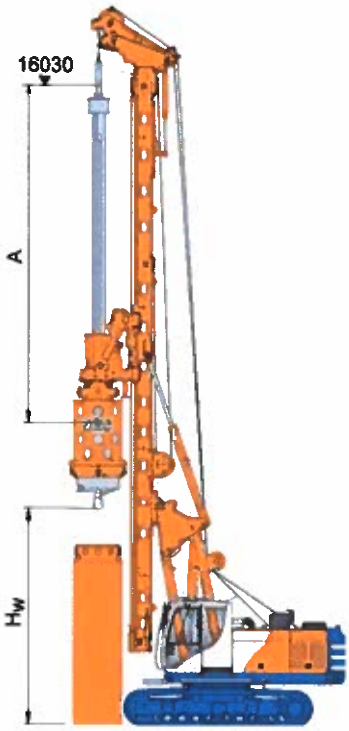
The base carrier BT 40 is designed and built by Bauer Maschinen. The engine and the hydraulic power pack are mounted in longitudinal direction. Such a construction principle ensures optimal air flow, low transport height, optimal cooling capacity at 40° ambient temperature.

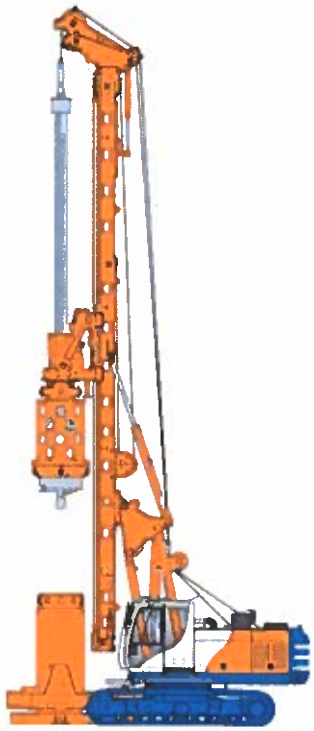
Motor, Stage III	**Engine,** Tier 3	**Cummins QSB 6.7**
Nennleistung ISO 3046-1	Rated output ISO 3046-1	201 kW @ 2100 U/min (rpm)
Motor spezifiziert nach Abgasnorm	Engine conforms to Exhaust Emission Standard	EEC 97/68EC Stage III und EPA/CARB Tier 3
Motor, Stage IV	**Engine,** Tier 4 final	**Cummins QSB 6.7**
Nennleistung ISO 3046-1 mit Leistungspaket	Rated output ISO 3046-1 with power package	201 kW @ 2100 U/min (rpm) 230 kW @ 2100 U/min (rpm)
Motor spezifiziert nach Abgasnorm	Engine conforms to Exhaust Emission Standard	EEC 97/68EC Stage IV und EPA/CARB Tier 4 final
Dieseltank	Diesel tank	500 l
AdBlue Tank (Stage IV)	AdBlue tank (Tier 4 final)	38 l
Schalldruckpegel in Kabine (EN 791, Anh. A)	Sound pressure level in cabin (EN 791, Annex A)	L_{pA} 80 dB(A)
Schallleistungspegel (2000/14/EG u. EN 791, Anh.A)	Sound power level (2000/14/EG u. EN 791, Annex A)	L_{WA} 112 dB(A)
Hydrauliksystem	**Hydraulic system**	Zweikreisbohrhydraulik 2-hydraulic circuit system for drilling
Hydraulikdruck	Hydraulic pressure	300 bar
Fördermengen (Hauptkreise + Hilfskreis)	Flow rates (main circuits + auxiliary circuit)	2 x 180 l/min + 1 x 105 l/min
Tankinhalt	Hydraulic oil tank capacity	500 l
Unterwagen (Teleskopfahrwerk)	**Undercarriage** (Retractable crawler frames)	**UW 45**
Laufwerksklasse	Crawler type	B 60
Spurweite (eingefahren/ausgefahren)	Track width (retracted/extended)	2.400 / 3.400 mm
Fahrwerksbreite (eingefahren/ausgefahren)	Overall width of crawlers (retracted/extended)	3.000 / 4.000 mm
3-Steg Bodenplatten	Width of triple grouser track shoes	600 mm
Fahrwerkslänge	Overall length of crawlers	4.710 mm
Zugkraft (effektiv / nominal)	Traction force (effective / nominal)	360 / 430 kN
Fahrgeschwindigkeit	Travel speed	1,5 km/h

Anwendungen — Applications

Kellybohrverfahren — Kelly drilling system







Standardverfahren:	unverrohrt, oder Einbau der Verrohrung mit Drehgetriebe
Option:	Einbau der Verrohrung mit angebauter hydraulischer Verrohrungsmaschine
Standard system:	Uncased drilling or installation of casing with rotary drive
Optional:	Installation of casing with hydraulic oscillator attached to the drilling rig

Zusatzausstattung / optional equipment:

Anbau Verrohrungsmaschine
Attachment of hydraulic oscillator
BV 1300 L-03

Bohrtiefen — Drilling depths

Kellytyp Type of kelly bar	A (m)	B (m)	Gewicht Weight (kg)	Hw (m)	T (m)
BK 15/343/3/18	8,30	20,20	2.930	5,40	**18,70**
BK 15/343/3/24	10,30	26,20	3.580	3,60	**24,70**
BK 15/343/3/30	12,30	32,20	4.300	1,60	**30,70**
BK 15/343/4/24	8,16	26,39	3.840	5,40	**24,90**
BK 15/343/4/32	10,16	34,39	4.620	3,70	**32,90**
BK 15/343/4/40	12,16	42,39	5.400	1,70	**40,90**

Bohrdurchmesser — Drilling diameter

Unverrohrt	Uncased	1.500 mm
Verrohrt	Cased	1.200 mm

Bohrrohrlängen — Length of casing sections

Ohne BV	Without casing oscillator	Hw – 0,5 m
Mit BV	With casing oscillator	Hw – 1,5 m

Bemerkungen zur Bohrdatenermittlung siehe „Kellystangen 905.518.1"

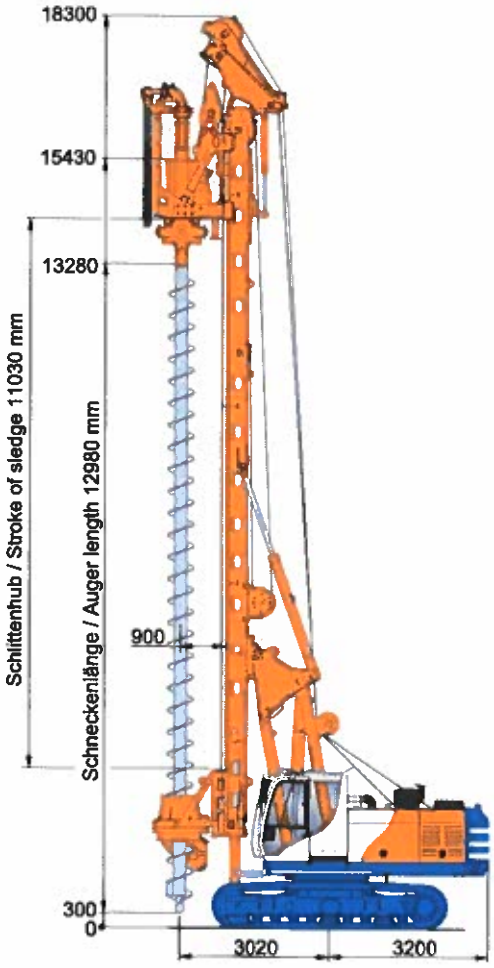
For further details on the acquisition of drilling data please refer to "Kelly Bars 905.518.1"

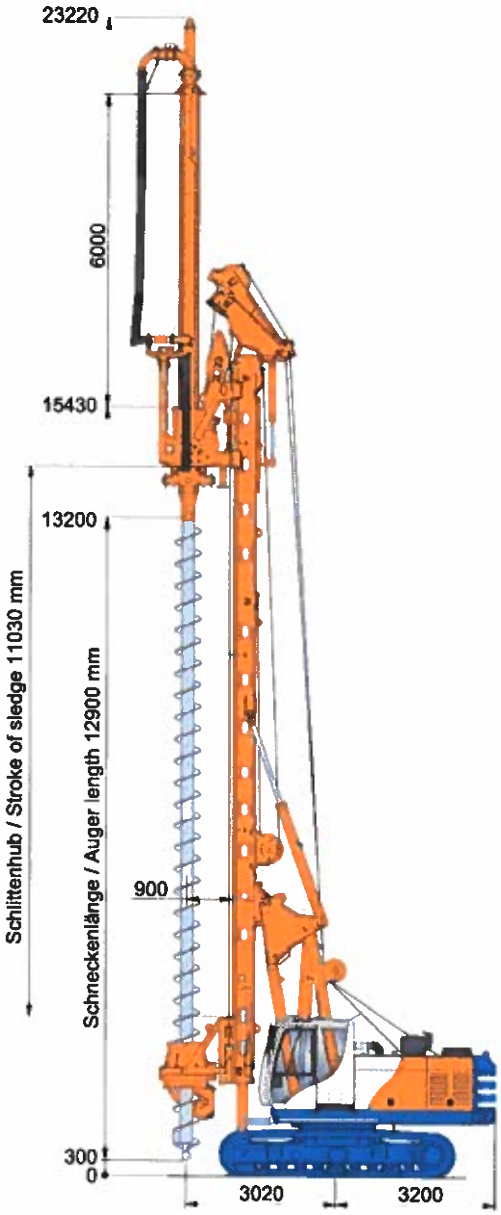
Anwendungen — Applications

SOB - Bohrverfahren — CFA - drilling system

hydraulische Mastabstützung erforderlich
Hydraulic mast support required

Zeichnung: Kombinierte Zugkraft mit Haupt- und Vorschubwinde mit modifizierter Aufhängung und Traverse
Drawing: Combined extraction force with crowd winch and main winch with modified connection and spreader beam

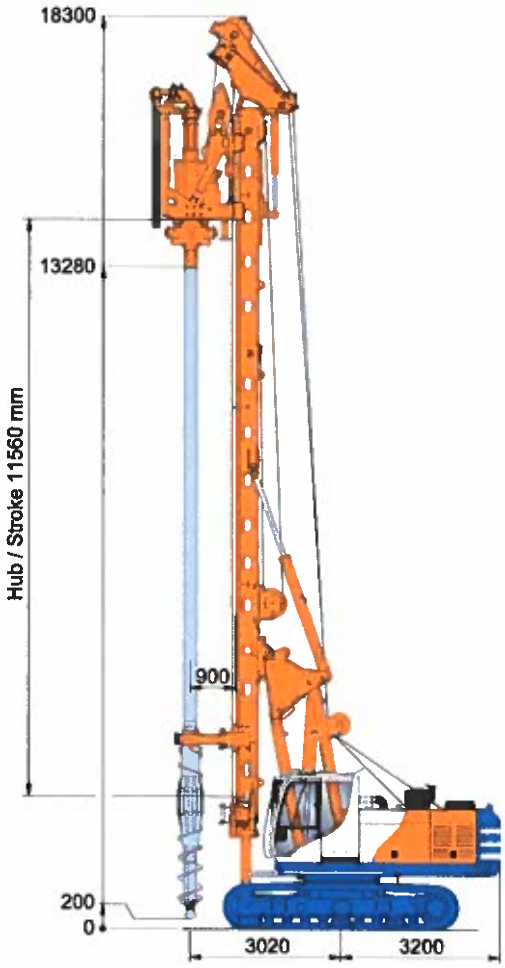


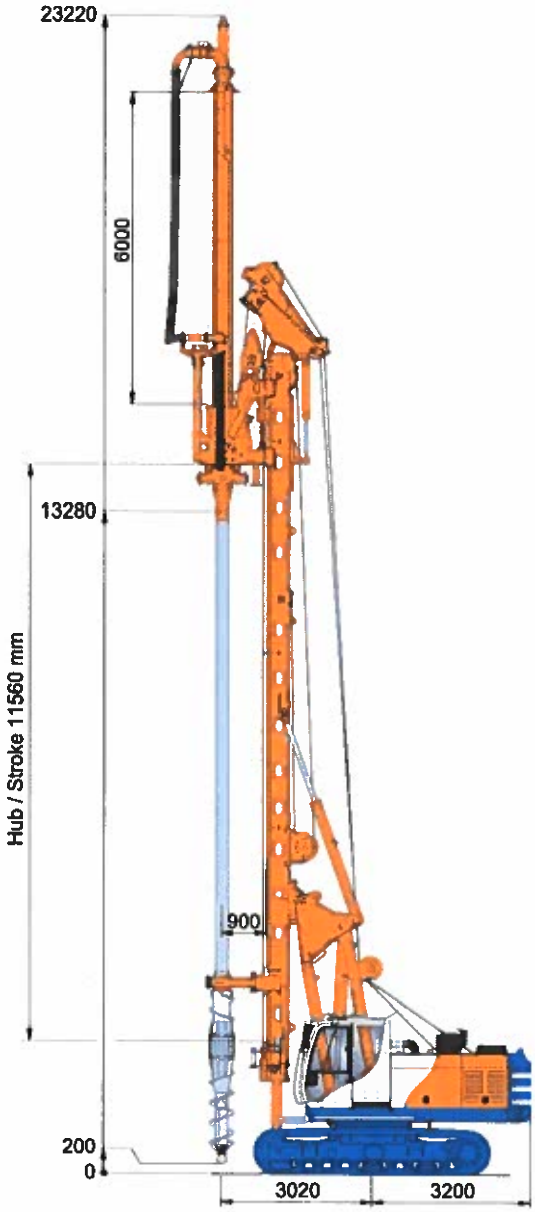


	ohne Kellyverlängerung without Kelly extension	mit Kellyverlängerung 6 m with Kelly extension 6 m
Bohrtiefe mit Schneckenputzer Drilling depth with auger cleaner	10,60 m	16,60 m
Bohrtiefe ohne Schneckenputzer Drilling depth without auger cleaner	11,70 m	17,70 m
Max. Bohrdurchmesser Max. drilling diameter	750 mm	750 mm
Max. Zugkraft Max. extraction force	200 kN	200 kN
Max. Zugkraft mit Haupt- und Vorschubwinde (effektiv) Max. extraction force with main- and crowd winch (effective)	420 kN	420 kN
Max. Anpresskraft Max. crowd force	150 kN + Gewicht Schnecke 150 kN + Weight of auger	150 kN + Gewicht Schnecke 150 kN + Weight of auger

FDP – Bohrverfahren Full displacement piling

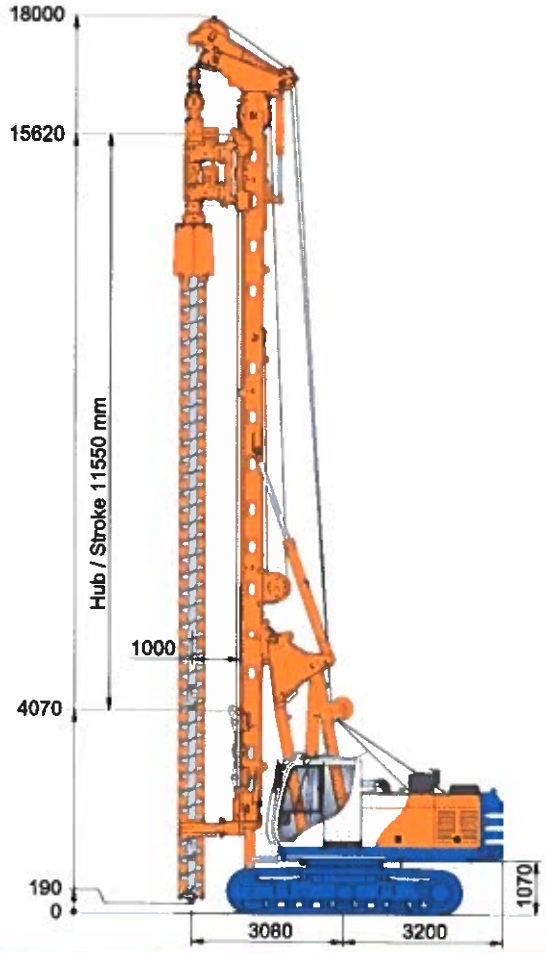
hydraulische Mastabstützung erforderlich
Hydraulic mast support required

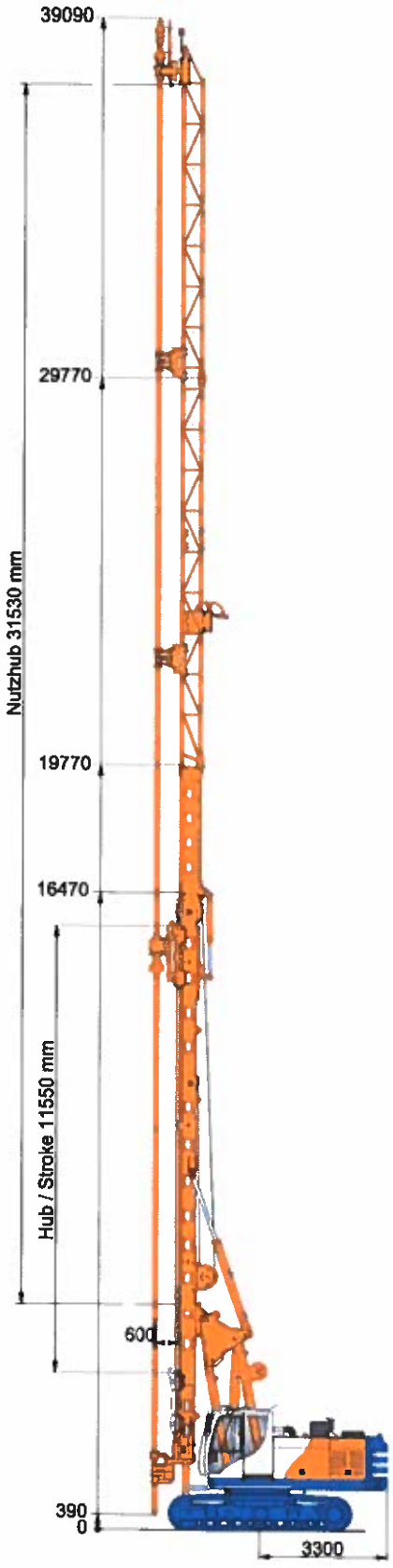




	ohne Kellyverlängerung without Kelly extension	mit Kellyverlängerung 6 m with Kelly extension 6 m
Bohrtiefe Drilling depth	11,20 m	17,20 m
Bohrdurchmesser Drilling diameter	360 – 510 mm	360 – 510 mm
Max. Zugkraft Max. extraction force	200 kN	200 kN
Max. Zugkraft mit Haupt- und Vorschubwinde (effektiv) Max. extraction force with main- and crowd winch (effective)	420 kN	420 kN
Max. Anpresskraft Max. crowd force	150 kN + Verdrängerausrüstung 150 kN + displacement equipment	150 kN + Verdrängerausrüstung 150 kN + displacement equipment

Anwendungen Applications





VdW - Bohrverfahren FoW - drilling system

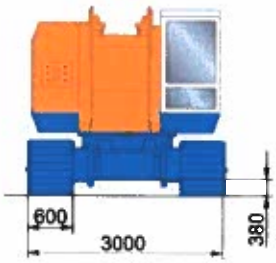
Max. Bohrtiefe Max. drilling depth	11,2 m
Bohrdurchmesser Drilling diameter	406 – 610 mm
Drehgetriebe Rotary drive	DKS 40/60
Leistungspaket 230 kW Power package 230 kW	empfohlen recommended

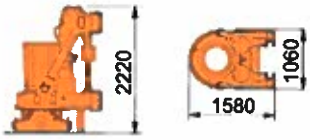
hydraulische Mastabstützung erforderlich
Hydraulic mast support required

HDI - Bohrverfahren Jet Grouting - drilling system

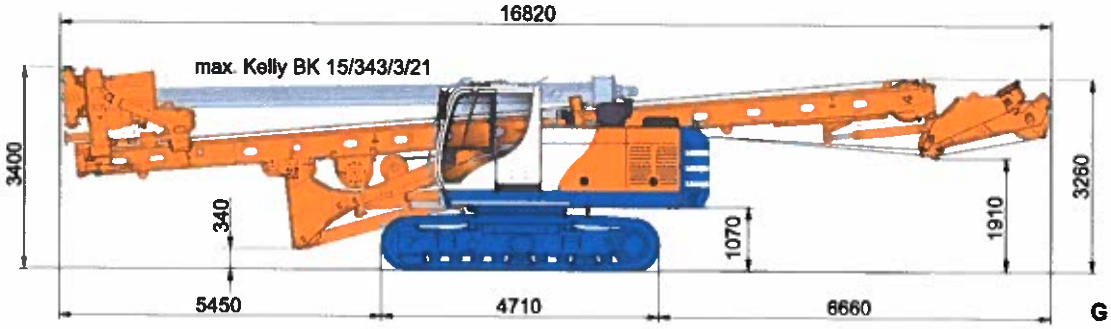
Max. Düstiefe Max. jetting depth	30,0 m
Bohrdurchmesser Drilling diameter	89 – 133 mm
Drehgetriebe Rotary drive	KDK 10 S
Zusatzgegengewicht Additional counterweight	2,25 t + 1,0 t

hydraulische Mastabstützung empfohlen
Hydraulic mast support recommended





G = 3,7 t



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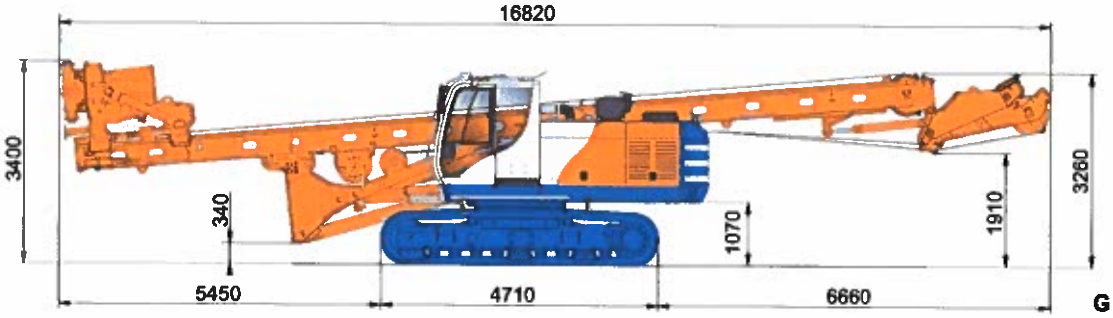
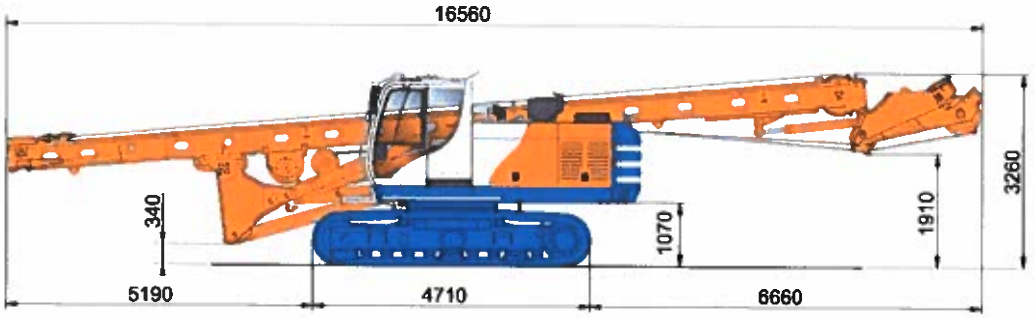


G = 42,7 t



G = 39 t
ohne Gegengewicht:
without counterweight:
G = 35 t

Gewichtsangaben sind ca. Werte, Zusatzausrüstungen (Optionen) können das Gesamtgewicht verändern

Weights shown are approximate values, optional equipment may change the overall weight

Die H-Gerätereihe

The H-model line

BG 15 H
BT 40

BG 18 H
BT 50

BG 20 H
BT 60

BG 24 H
BT 75

BG 28 H
BT 85

BG 34 H
BS 95

PremiumLine

bma.bauer.de

BAUER Maschinen GmbH
BAUER-Straße 1
86529 Schrobenhausen
Germany
Tel. +49 82 52 97-0
bma@bauer.de
www.bauer.de

905.804.1+2 2/2018

TOUGHER > FASTER > SIMPLER

WATSON DRILL RIGS

EX90/130

90,000 / 130,000 ft-lb
122 / 176 kNm

SPIN OFF 100 rpm

LINEPULL
30,000 / 40,000 lb
133 / 178 kN

WEIGHT
107,000 / 113,000 lbs
48.5 / 51.2 mT

MAX DEPTH 94 ft, 28.7 m

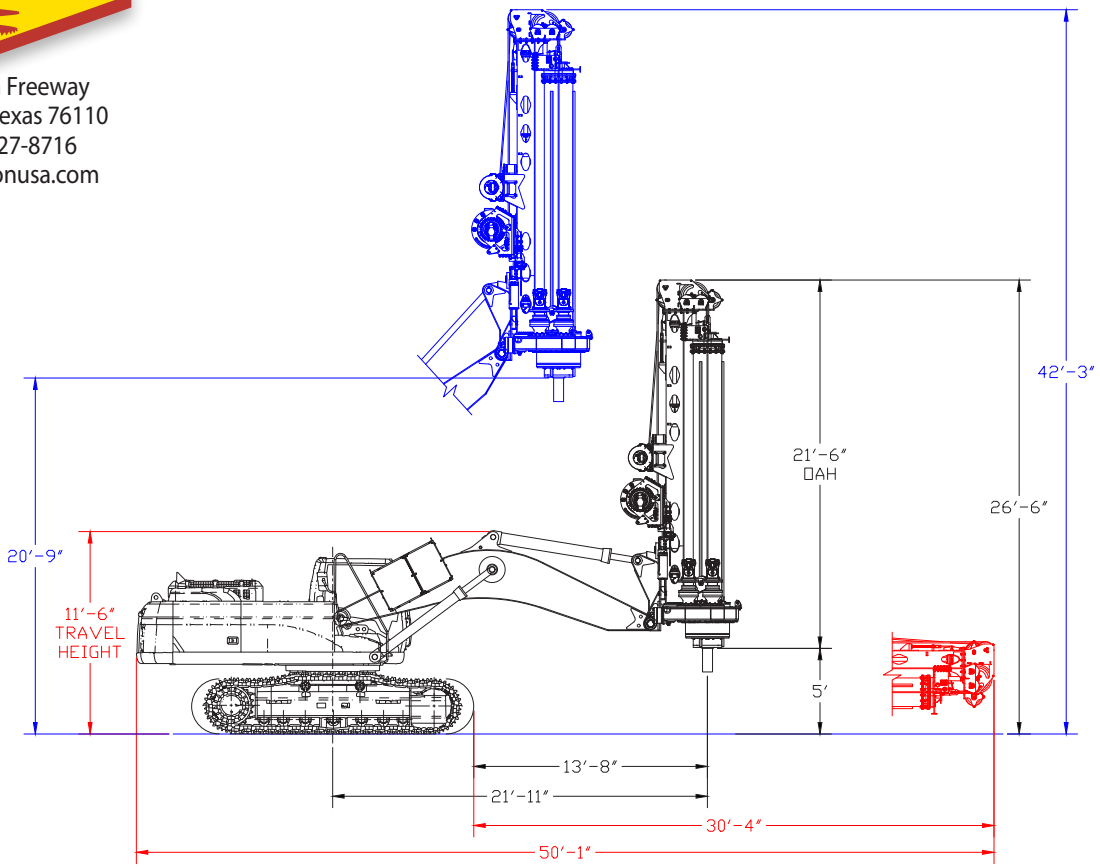
WATSONUSA.COM
800-927-8486

MADE IN USA

DRILL MORE HOLES

EXCADRILL - EX90/130

4015 South Freeway
Fort Worth, Texas 76110
Fax 817-927-8716
sales@watsonusa.com



PERFORMANCE	EX90	EX130
TORQUE	90,000 ft-lb 122 kNm	130,000 ft-lb 176 kNm
DRILL SPEED	0 TO 60 rpm	
SPIN OFF	100 rpm	100 rpm
KELLY WINCH With FREEFALL	30,000 lbs 133 kN	40,000 lbs 178 kN
SERVICE WINCH	12,000 lbs 53 kN	12,000 lbs 53 kN
CROWD FORCE	25,000 lbs 111 kN	30,000 lbs 133 kN

CONFIGURATION		
BASE MACHINE	CAT 329FL	CAT 336FL
TRANSPORT WEIGHT	107,000 lbs 48,530 kgs	113,000 lbs 51,255 kgs
DRILLING DEPTH	94 ft	94 ft
(5-ELEMENT)	28.7M	28.7M
SIDE TILT	7° left/right	

DEFINING FEATURES

Tri-Drive Rotary achieves max torque and max spinoff without clutches or gear shifting

Full excavator horsepower delivered to the tool

Interchangeable Heavy Duty Kellys, swap square & round kellys to match drilling conditions

Large diameter 24" Rotary utilizes **bigger bars** which means less wear

Full Top Crowd drills straighter holes and simplifies bar locking

Single layer, grooved Kelly winch drum for max linepull and longer rope life

Controlled freefall, 2-speed Kelly winch for faster cycle times

Optimized hydraulic interface for simpler operation and maintenance

STANDARD OPTIONS

Custom mast heights and bar sets available to meet specific drill depth needs

Can be mounted to any make excavator from 29-45 metric ton

Quick disconnect boom/counterweight

Customer Kelly stubs/service winches/paint schemes

Reaction Jack for increased performance on hard rock

a TREVIGroup company

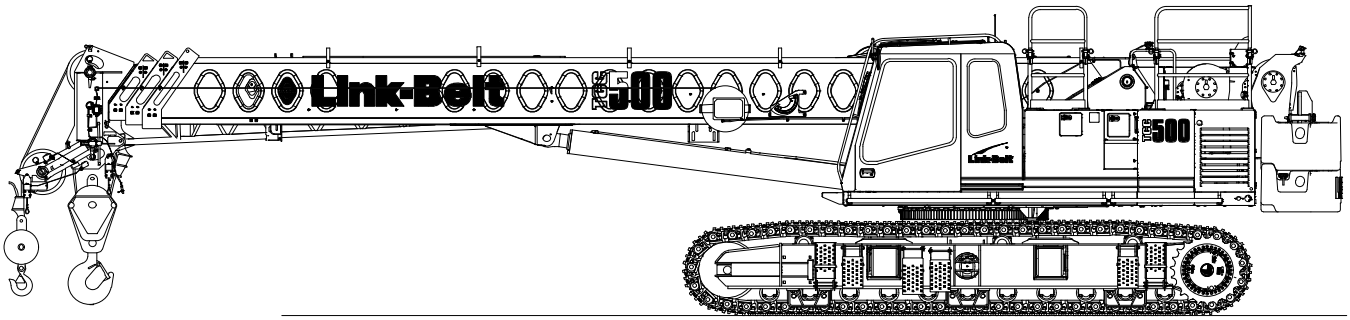
Technical Data

Specifications & Capacities

TCC 500

Telescopic Crawler Crane

50 Ton *(51mt Export Machine)*



CAUTION: This material is supplied for reference use only. Operator must refer to in—cab Crane Rating Manual and Operator's Manual to determine allowable crane lifting capacities and assembly and operating procedures.

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Upper Structure

Frame

All welded steel frame with precision machined surfaces for mating parts.

Turntable Bearing

- Inner race is bolted to upper frame
- Outer race with external swing gear is bolted to lower frame

Engine

Engine

Full pressure lubrication, oil filter, air cleaner, hour meter, throttle, and electric control shutdown.

Specification	Cummins QSB	
	Tier 4f (Stage 3B)	Tier 3 (Stage 3A)
Numbers of Cylinders	6	6
Cycle	4	4
Bore & Stroke: inch (*mm*)	4.21 x 4.88 (107 *x 124*)	4.21 x 4.88 (107 *x 124*)
Piston Displacement: in^3 (*L*)	409 (*6.7*)	409 (*6.7*)
Max. Brake Horsepower: hp (*kW*)	215 (*160*) @ 1,800 rpm	205 (*153*) @ 1,800 rpm
Peak Torque: ft lb (*Nm*)	700 (*949*) @ 1,500 rpm	689 (*929*) @ 1,300 rpm
Alternator: volt — amps	12 — 150	12 — 160
Crankcase Capacity: qt (*L*)	19 (*18*)	19 (*18*)
• Engine driven variable speed viscus fan clutch and thermostatically controlled radiator		

Fuel Tank

One 80 gal *(303L)* capacity fuel tank.

Hydraulic System

Hydraulic Pumps

The pump arrangement is designed to provide hydraulically powered functions allowing positive, precise control with independent or simultaneous operation of all crane functions.

- One variable displacement pumps provide independent control for hoist drums, boom hoist, boom extend, and right & left travel.
- Two gear type pumps are used for the swing, retract cylinders & operator's controls and hydraulic oil cooling fan.

Hydraulic Reservoir

133 gal (*504L*) capacity equipped with sight level gauge. Diffusers built in for deaeration.

Filtration

One 10 micron, full flow return line filter. Accessible for easy filter replacement.

Counterbalance Valves

All hoist motors are equipped with counterbalance valves to provide positive load lowering and prevent accidental load drop if the hydraulic pressure is suddenly lost.

Load Hoist Drums

Main and Optional Auxiliary Winches

- Axial piston, full and half displacement (2—speed) motor driven through planetary reduction unit for positive control under all load conditions.
- Grooved lagging
- Power up/down mode of operation
- Hoist drum cable follower — optional
- Drum rotation indicator
- Drum diameter: 10.63 in (*27cm*)
- Rope length:
  - Main: 600 ft (*182.9m*)
  - Auxiliary: 450 ft (*137.2m*) or 600 ft (*182.9m*)
- Maximum rope storage: 737 ft (*224.6m*)
- Terminator style socket and wedge

Third wrap indicator — optional — Visually and audibly warns the operator when the wire rope is on the first/bottom layer and when the wire rope is down to the last three wraps

Swing System

Motor/Planetary — Bi—directional hydraulic swing motor mounted to a planetary reducer for 360° continuous smooth swing at 2.0 rpm

Swing Park Brake — 360°, electric over hydraulic, (spring applied/hydraulic released) multi—disc brake mounted on the speed reducer. Operated by a switch in the operator's cab.

Swing Brake — 360°, foot operated, hydraulic applied disc brake mounted to the speed reducer

House Lock — Two—position house lock (boom over front or rear) operated from the operator's cab

Counterweight

Consists of a five piece design.

- One "A" counterweight, 12,000 lb *(5 443kg)*
- One "B" counterweight, 13,000 lb *(5 897kg)*
- Optional one "C" counterweight, 5,000 lb *(2 268kg)*
- Optional two "A" carbody counterweights, 3,000 lb *(1 361kg)* each with tool box built in

Operator's Cab

Fully enclosed modular steel compartment is independently mounted and padded to protect against vibration and noise.

- All tinted/tempered safety glass
- Sliding entry door and front and rear window
- Swing up roof window with windshield wiper
- Door and window locks
- Hot water heater
- Air conditioner
- Sun visor
- Cloth seat
- Circulating fan
- Windshield wipers and washer
- Dry chemical fire extinguisher
- Engine instrumentation panel (tachometer, voltmeter, engine oil pressure, engine water temperature, fuel level, hydraulic oil temperature, hour meter, and service monitor system)
- Mechanical drum rotation indicators for main (rear) and auxiliary (front) hoist drums
- Six way adjustable seat
- Foot throttle
- Joystick controls
- Optional fully adjustable single axis controls
- Bubble type level
- Ergonomic gauge layout
- Controls shut off lever
- AM/FM Radio
- Travel levers & pedals
- Camera (winch & rear view)

Rated Capacity Limiter System

Link—Belt Pulse — The Link—Belt in—house designed, total crane operating system that utilizes the display as a readout and operator interface for the following systems:

- Crane configuration
- Boom length
- Boom head height
- Allowed load and % of allowed load
- Data logging
- Boom angle
- Radius of load
- Actual load
- Operator settable alarms (include):
  - Maximum and minimum boom angles
  - Maximum tip height
  - Maximum boom length
  - Swing left/right positions
  - Operator defined area (imaginary plane)

Telematics — Cellular—based data logging and monitoring system that provides:

- Location and operational settings
- Routine maintenance
- Crane and engine monitoring
- Diagnostic and fault codes

Machinery House

Hinged doors (four on right side) for machinery access.

Catwalks

Standard on right and left sides. Catwalks fold up and pin for reduced travel width.

Optional Vandal Guards

Under design

Lower Structure

Carbody

Lower Frame

All welded box construction frame with precision machined surfaces for turntable bearing and rotating joint.

Side Frames

Side Frames

All welded, precision machined, steel frames can be hydraulically extended and retracted with a hydraulic cylinder mounted in the lower frame.

- 12 ft 6.88 in *(3.83m)* extended gauge
- 10 ft 10.62 in *(3.31m)* intermediate gauge
- 8 ft 9.74 in *(2.68m)* retracted gauge
- 19 ft 6.19 in *(5.95m)* overall length
- 31 in 6 in *(0.80m)* wide track shoes
- Sealed (oil filled) idler and drive planetaries
- Compact travel drives
- Hydraulic self adjusting tracks

Track Rollers

- Eleven sealed (oil filled) track rollers per side frame
- Heat treated, mounted on anti—friction bearings

Tracks

Heat treated, self—cleaning grouser shoes and heat treated track pins with dirt seals. 61 track shoes per side.

- Optional flat or “street” pad

Take Up Idlers

Cast steel, heat treated, self—cleaning, mounted on sealed tapered roller bearings

Travel and Steering

Each side frame contains a pilot controlled, bi—directional, axial piston motor and a planetary gear reduction unit to provide positive control under all load conditions.

- 2—speed travel
- Individual control provides smooth, precise maneuverability including full counter—rotation.
- Spring applied, hydraulically released multiple wet—disc type brake controlled automatically
- Maximum travel speed is 2 mph *(3.2km/h)*.
- Designed to 40% gradeability

Tool Boxes

Two heavy duty steel design tool boxes that bolt onto the carbody.

Boom

Design

Four section, box type construction of high tensile steel consisting of one base section and three telescoping sections. The vertical side plates have diamond shaped steel impressions for superior strength to weight ratio. The first telescoping section extends independently by means of one double—acting, single stage hydraulic cylinder with integrated holding valves. The second and third telescoping sections extend proportionally by means of one double—acting, single stage cylinder with integrated holding valves and cables.

Boom

- 35 ft 6 in—110 ft (*10.8—33.8m*) four section full power boom
- Two mode boom extension: A*max mode provides superior capacities by extending the first telescoping section to 60 ft 4 in (*18.4m*). Standard mode synchronizes all the telescoping sections proportionally to 110 ft (*33.5m*). Controlled from the operator's cab.
- Mechanical boom angle indicator
- Maximum tip height for A—max mode is 67 ft (*20.4m*) and standard mode is 115 ft 6 in (*35.2m*).

Boom Head

- Four 16.5 in (*41.9cm*) root diameter sealed bearings nylon sheaves to handle up to eight parts of line
- Easily removable wire rope guards
- Rope dead end lugs on each side of the boom head
- Boom head is designed for quick—reeve of the hook block

Boom Elevation

- One double acting hydraulic cylinder with integral holding valve
- Boom elevation: —3° to 78°

Optional Equipment

Auxiliary Lifting Sheave

- Single 16.5 in (*41.9m*) root diameter nylon sheave
- Easily removable wire rope guard
- Does not affect erection of the fly or use of the main head sheaves

Hook Blocks And Balls

- 25 ton (*22.3mt*) 3 sheave quick—reeve hook block with safety latch
- 40 ton (*36.3mt*) 4 sheave quick—reeve hook block with safety latch
- 50 ton (*44.6mt*) 5 sheave quick—reeve hook block with safety latch
- 8.5 ton (*7.7mt*) swivel and non—swivel hook balls with safety latch

Fly & Attachments

- 28.5 ft (*11.7m*) one piece lattice fly, stowable, offsettable to 2°, 20°, and 40°. Maximum tip height is 143.5 ft (*43.74m*).
- 28.5—51 ft (*8.7—15.6m*) two piece bi—fold lattice fly, stowable, offsettable to 2°, 20°, and 40°. Maximum tip height is 165.5 ft (*50.44m*).

Work Platform

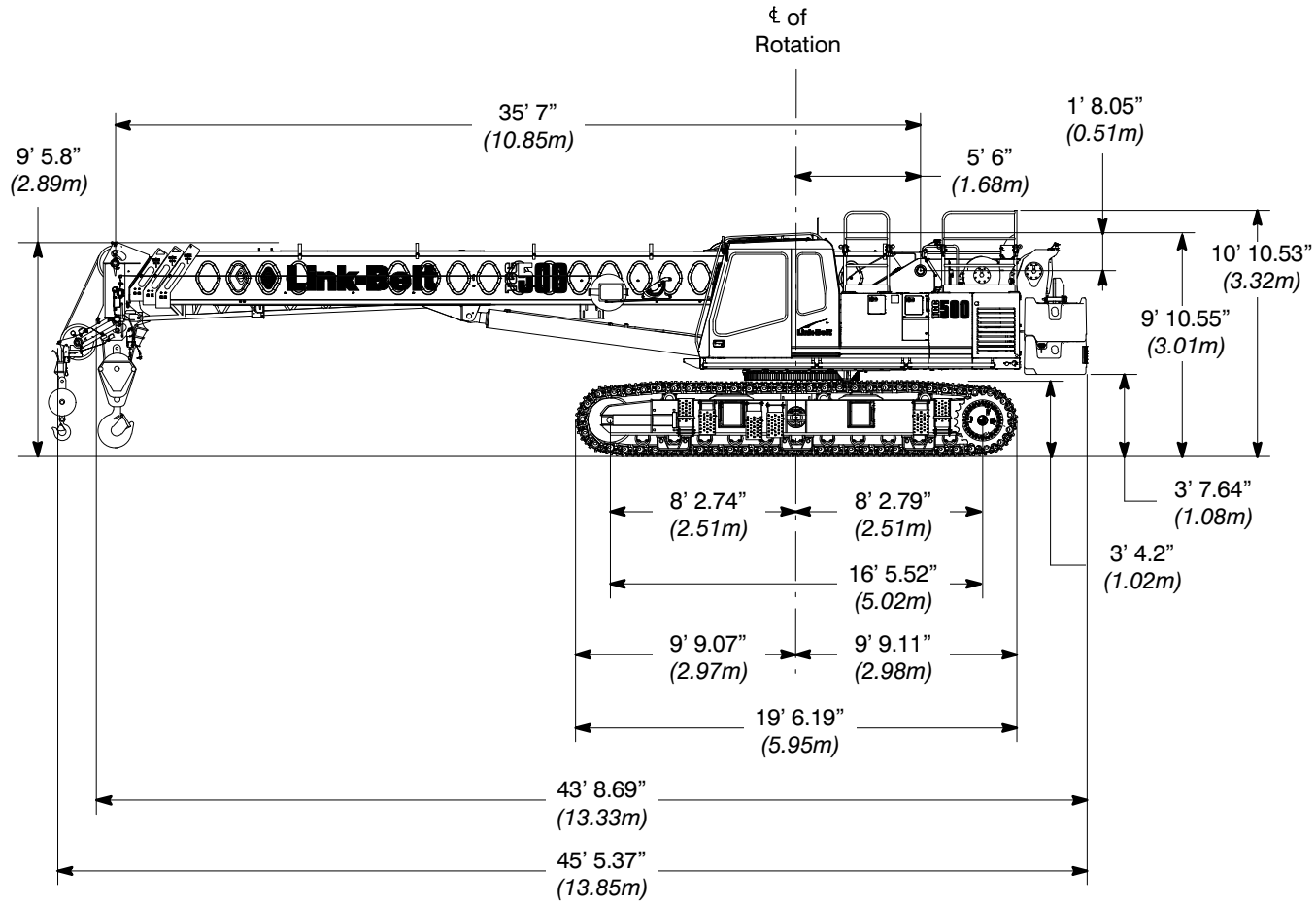
- Boom mounted work platform under design.

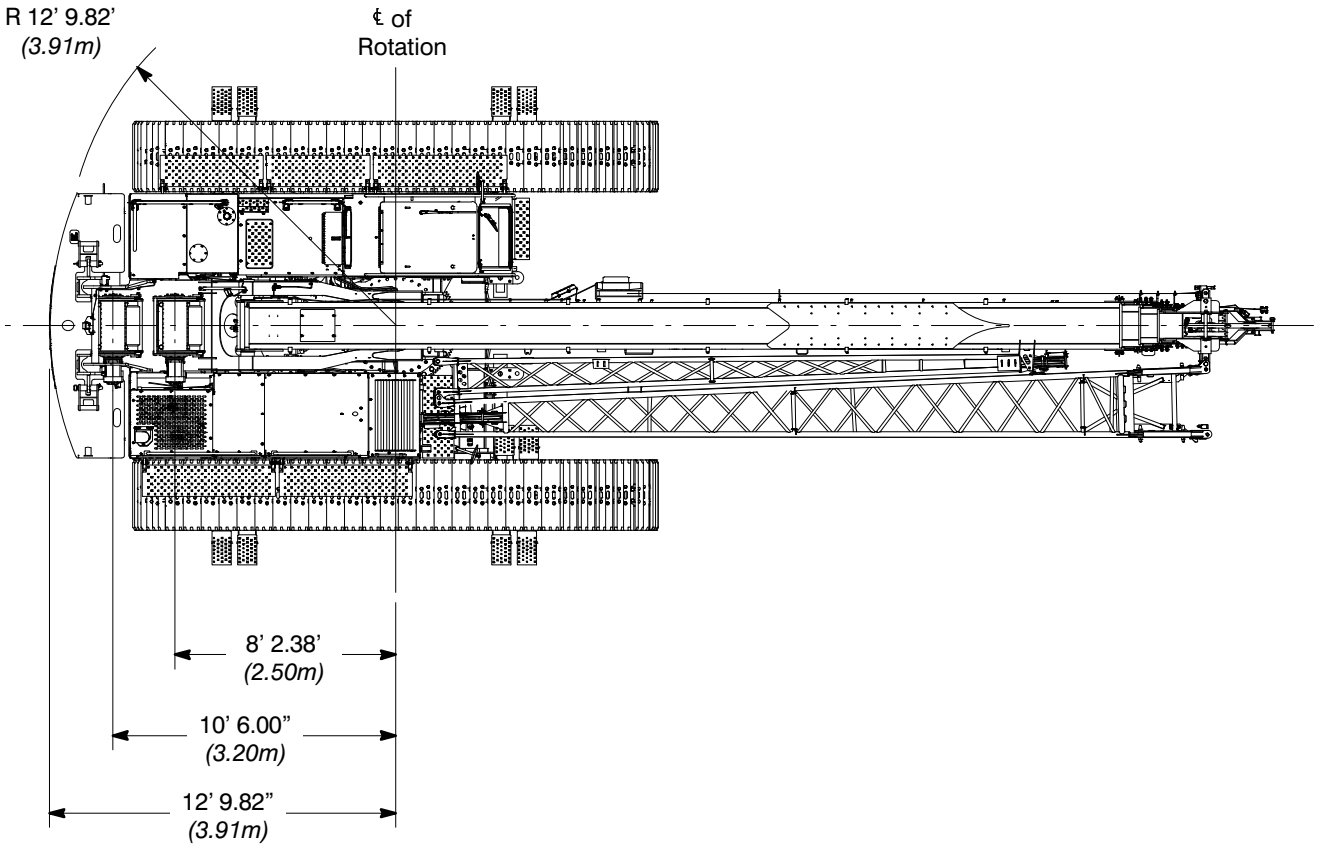
Auger Mounting (Under Design)

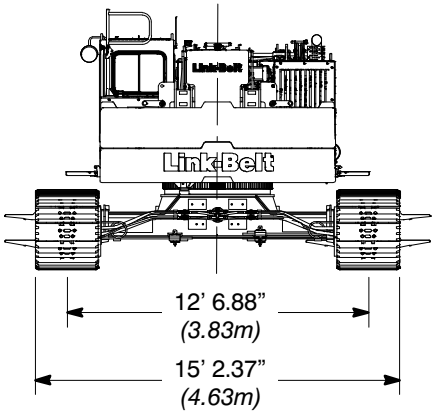
This option provides for all parts required for installation of "Pengo Model DT15 & RT—20 Augers". Included in option are all operator cabin controls, main hydraulic valve, and plumbing. The auger mounts to the boom tip section in operational mode and stores on the base section when not working. Design allows for limited boom extend and retract while drilling, allowing for straight vertical drilling.

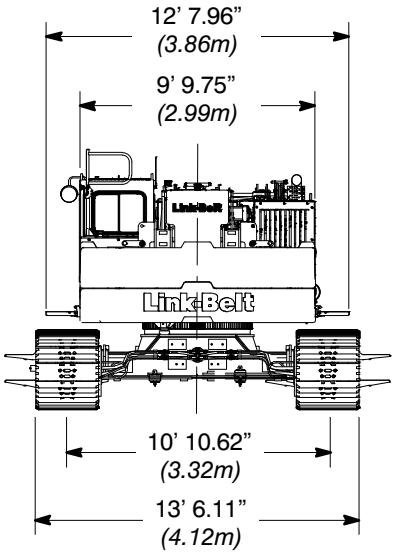
Dimensions
Base Crane

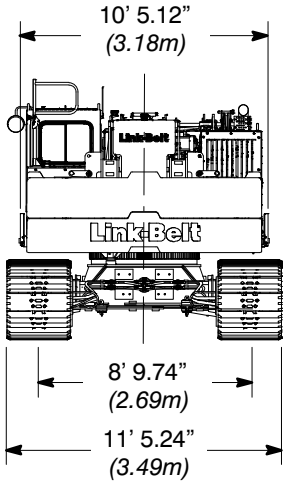
General Dimensions	English	*Metric*
Basic Boom	35.5—110 ft	*10.8—33.5m*
Minimum Load Radius	10 ft	*3.05m*
Maximum Boom Angle	78°	*78°*
Track Shoe Width	31.5 in	*0.80m*




R 12’ 9.82’
(3.91m)
℄ of
Rotation
8’ 2.38’
(2.50m)
10’ 6.00”
(3.20m)
12’ 9.82”
(3.91m)


12’ 6.88”
(3.83m)
15’ 2.37”
(4.63m)

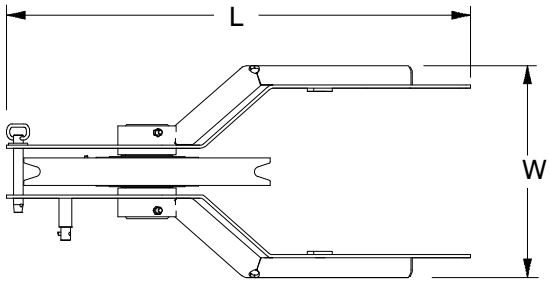

12’ 7.96”
(3.86m)
9’ 9.75”
(2.99m)
10’ 10.62”
(3.32m)
13’ 6.11”
(4.12m)

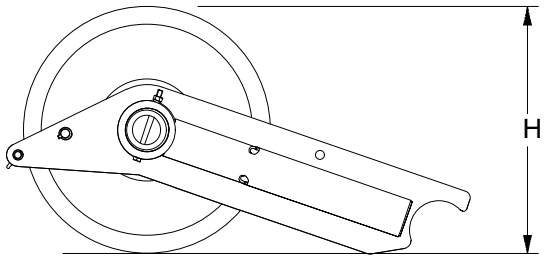

10’ 5.12”
(3.18m)
8’ 9.74”
(2.69m)
11’ 5.24”
(3.49m)

Auxiliary Lifting Sheave

Auxiliary Lifting Sheave ❶

Length	35.31 in	*(0.90m)*
Width	16.31 in	*(0.41m)*
Height	19 in	*(0.48m)*
Weight	92.5 lb	*(42kg)*

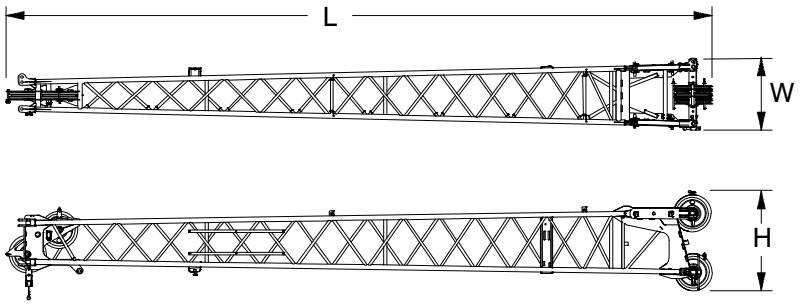




Fly

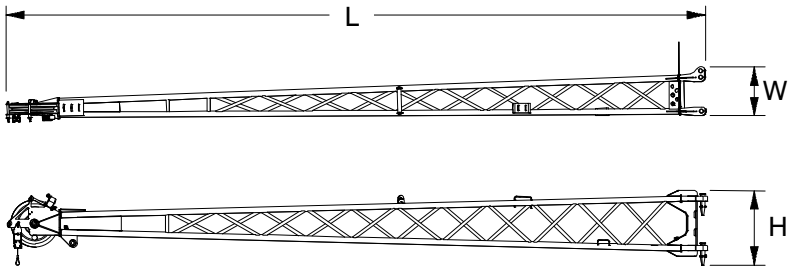
28.5 ft *(8.69m)* Offset Fly One Piece Lattice Fly (Base Fly) ❶

Length	28.5 ft	*(8.69m)*
Width	29 in	*(0.74m)*
Height	30 in	*(0.76m)*
Weight	1,188 lb	*(539kg)*



22.5 ft *(6.86m)* Lattice Fly Tip (Addition To Base Fly For 28.5—51 ft *(8.69—15.55m)* Bi—fold Fly) ❶

Length	22.5 ft	*(6.86m)*
Width	13.78 in	*(0.35m)*
Height	20 in	*(0.51m)*
Weight	654 lb	*(297kg)*



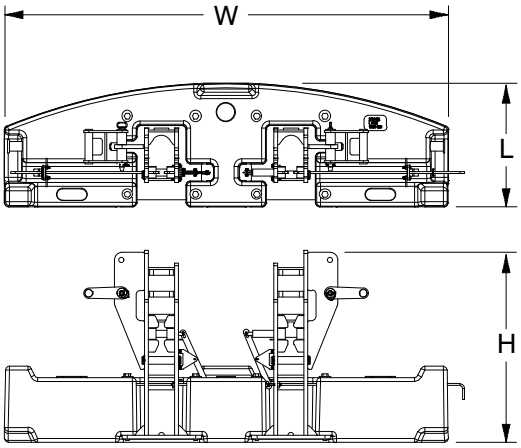
Number inside black circle "❶" = # of components

* — Optional equipment

Counterweights

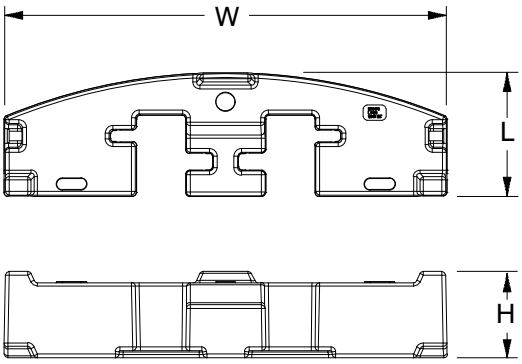
“A” Counterweight ❶

Length	32.90 in	*(0.84m)*
Width	9 ft 10 in	*(3.00m)*
Height	4 ft 2.18 in	*(1.28m)*
Weight	12,000 lb	*(5 443kg)*



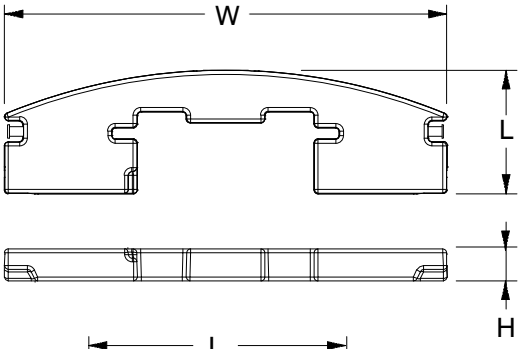
“B” Counterweights ❶

Length	32.90 in	*(0.84m)*
Width	9 ft 10 in	*(3.00m)*
Height	23 in	*(0.58m)*
Weight	13,000 lb	*(5 897kg)*



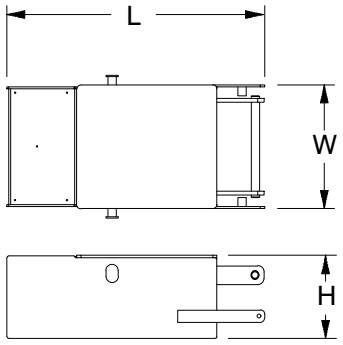
Optional “C” Counterweights ❶

Length	32.90 in	*(0.84m)*
Width	9 ft 10 in	*(3.00m)*
Height	8.50 in	*(0.22m)*
Weight	5,000 lb	*(2 268kg)*



Optional “A” Carbody Counterweights ❷

Length	62.50 in	*(1.59m)*
Width	30 in	*(0.76m)*
Height	20.12 in	*(0.51m)*
Weight	3,000 lb	*(1 361kg)*



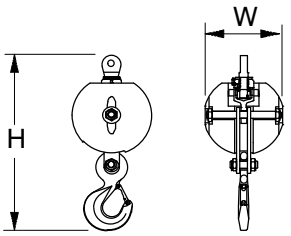
Number inside black circle “❶” = # of components

* — Optional equipment

Hook Balls

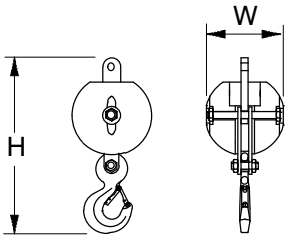
8.5 Ton *(7.7mt)* Swivel Hook Ball* ❶

Width	14.50 in	*(0.37m)*
Height	33.75 in	*(0.86m)*
Weight	325 lb	*(163kg)*



8.5 Ton *(7.7mt)* Non—Swivel Hook Ball* ❶

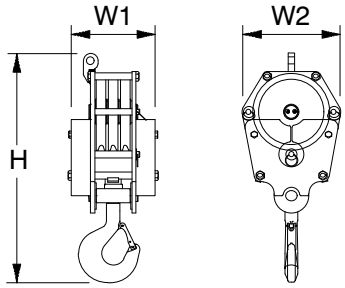
Width	14.50 in	*(0.37m)*
Height	33.80 in	*(0.86m)*
Weight	360 lb	*(163kg)*



Hook Blocks

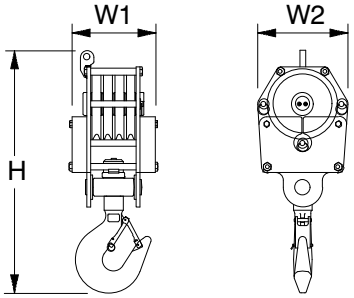
25 Ton *(22.3mt)* 3—Sheave Hook Block* ❶

Width1	15.14 in	*(0.39m)*
Width2	17.88 in	*(0.45m)*
Height	41.17 in	*(1.05m)*
Weight	670 lb	*(304kg)*



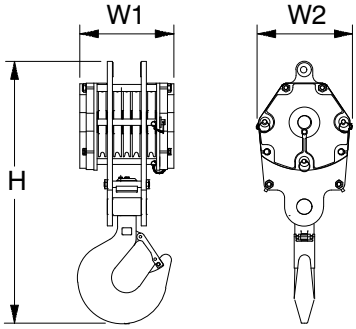
40 Ton *(36.3mt)* 4—Sheave Hook Block* ❶

Width1	16.44 in	*(0.42m)*
Width2	17.88 in	*(0.45m)*
Height	47.82 in	*(1.22m)*
Weight	780 lb	*(354kg)*



50 Ton *(44.6mt)* 5—Sheave Hook Block* ❶

Width1	18.75 in	*(0.48m)*
Width2	18.25 in	*(0.46m)*
Height	52.31 in	*(1.33m)*
Weight	1,090 lb	*(494kg)*



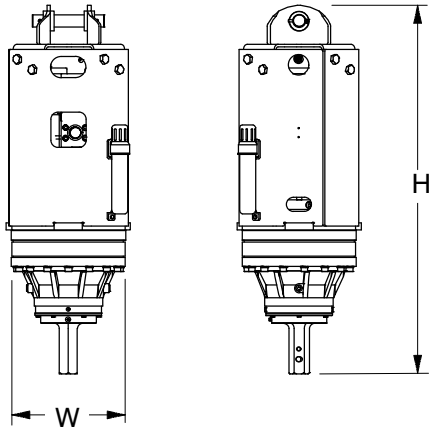
Number inside black circle "❶" = # of components

* — Optional equipment

Augers

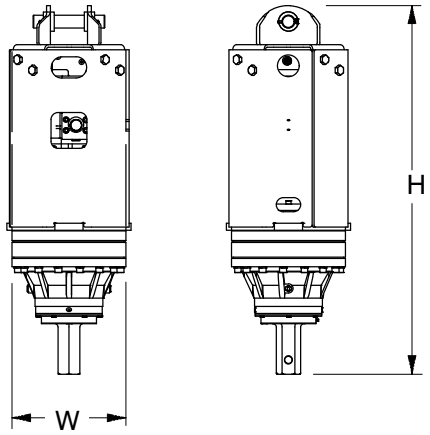
DT—15 Auger* ❶

Width	16.12 in	*(0.41m)*
Height	52.12 in	*(1.32m)*
Weight	710 lb	*(322kg)*
Hex Shaft	2.5 in	*(6.35cm)*



RT—20 Auger* ❶

Width	16.12 in	*(0.41m)*
Height	52.12 in	*(1.32m)*
Weight	737 lb	*(334kg)*
Hex Shaft	3 in	*(7.62cm)*



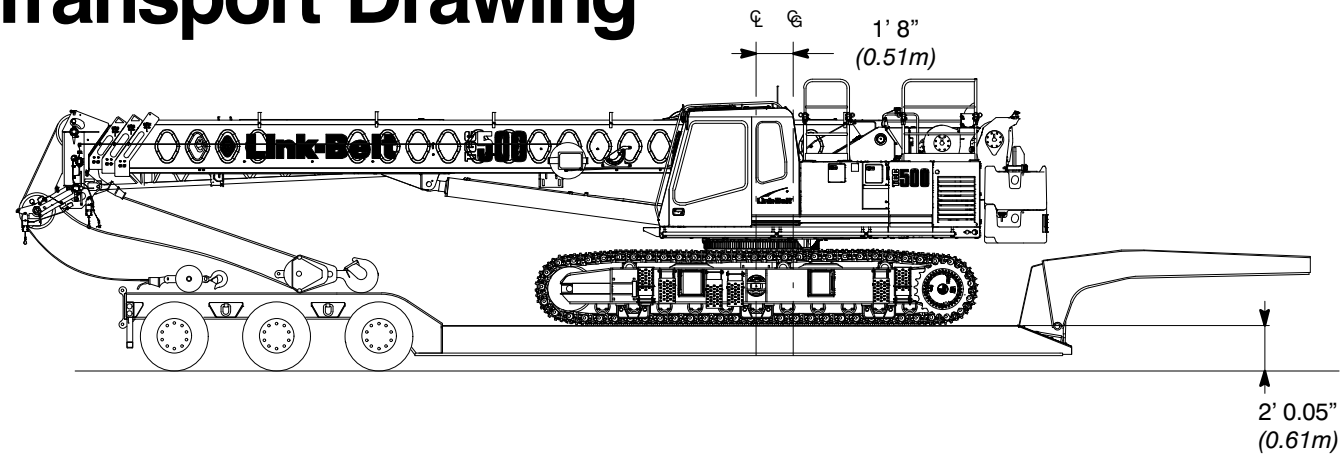
Number inside black circle "❶" = # of components

* — Optional equipment

Working Weights

Option	Description	Gross Weight lb *(kg)*	Ground Bearing Pressure (on soft ground) psi *(kg/cm²)*
1	Base crane, "AB" counterweight, lower toolbox, 600 ft *(182.9m)* type "ZB" main wire rope, 450 ft *(137.2m)* type "ZB" auxiliary wire rope, 2—piece fly, 40 ton *(36.29mt)* 4 sheave hook block, 8.5 ton *(7.71mt)* hook ball, and a 250 lb *(113kg)* operator.	100,000 *(45 359kg)*	8.88 *(0.62)*
Notes:	Ground bearing pressure is based on the total weight distributed evenly over the track contact area.		

Transport Drawing



Transport Weight — 99,750 lb *(45 246kg)*

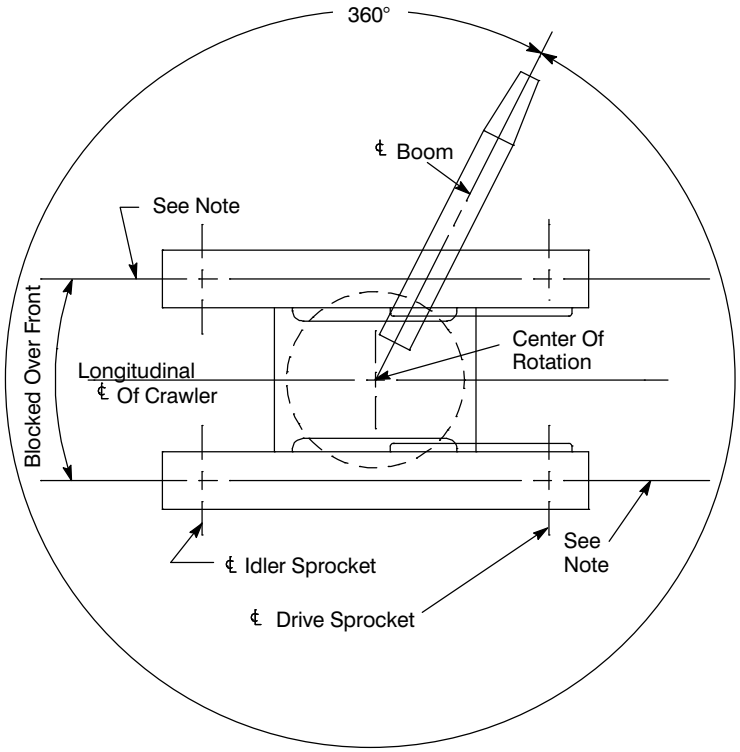
Base crane, "AB" Counterweight, 600 ft *(182.9m)* type "ZB" main wire rope, 450 ft *(137.2m)* type "ZB" auxiliary wire rope, 2—piece fly, 40 ton *(36.29mt)* 4 sheave hook block, and 8.5 ton

Load Hoist Performance

Main (Rear) and Auxiliary (Front) Winches — 5/8 in (*16mm*) Rope										
	Maximum Line Pull		Normal Line Speed		High Line Speed		Layer		Total	
Layer	lb	*kN*	ft/min	*m/min*	ft/min	*m/min*	ft	*m*	ft	*m*
1	17,084	*75.99*	181	*55.2*	360	*109.6*	97	*29.6*	97	*29.6*
2	15,454	*68.74*	200	*61.1*	398	*121.2*	107	*32.6*	205	*62.4*
3	14,107	*62.75*	219	*66.9*	436	*132.8*	118	*35.9*	322	*98.3*
4	12,977	*57,72*	239	*72.7*	474	*144.3*	128	*39.0*	451	*137.3*
5	12,014	*53.44*	258	*78.6*	511	*155.9*	138	*42.1*	589	*179.5*
6	11,184	*49.75*	277	*84.4*	549	*167.5*	149	*45.3*	737	*224.7*

Wire Rope Application		Diameter		Type	Maximum Permissible Load	
		in	*mm*		lb	*kg*
Main (Rear) Winch	Standard	5/8	*16*	34x7 rotation resistant — right regular lay or right lang lay (Type ZB)	11,080	*5 025.8*
	Optional	5/8	*16*	18x19 rotation resistant — right regular lay or right lang lay (Type RB)	9,080	*4 118.6*
	Optional	5/8	*16*	6x19 IWRC — right regular lay (Type DB)	11,771	*5 339.2*
Auxiliary (Front) Winch	Standard	5/8	*16*	34x7 rotation resistant — right regular lay (Type ZB)	11,080	*5 025.8*
	Optional	5/8	*16*	18x19 rotation resistant — right regular lay (Type RB)	9,080	*4 118.6*
	Optional	5/8	*16*	6x19 IWRC — right regular lay (Type DB)	11,771	*5 339.2*

Working Areas

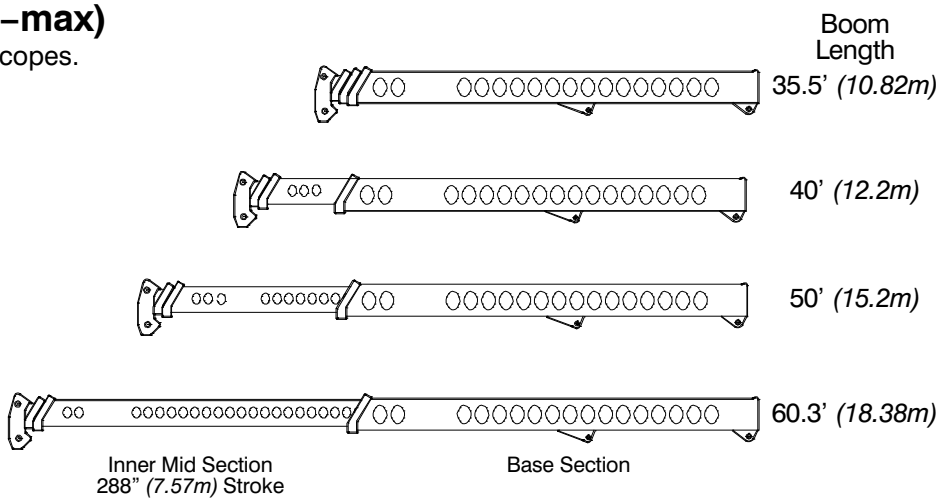


Note: These Lines Determine The Limiting Position Of Any Load For Operation Within Working Areas Indicated.

Boom Extend Modes

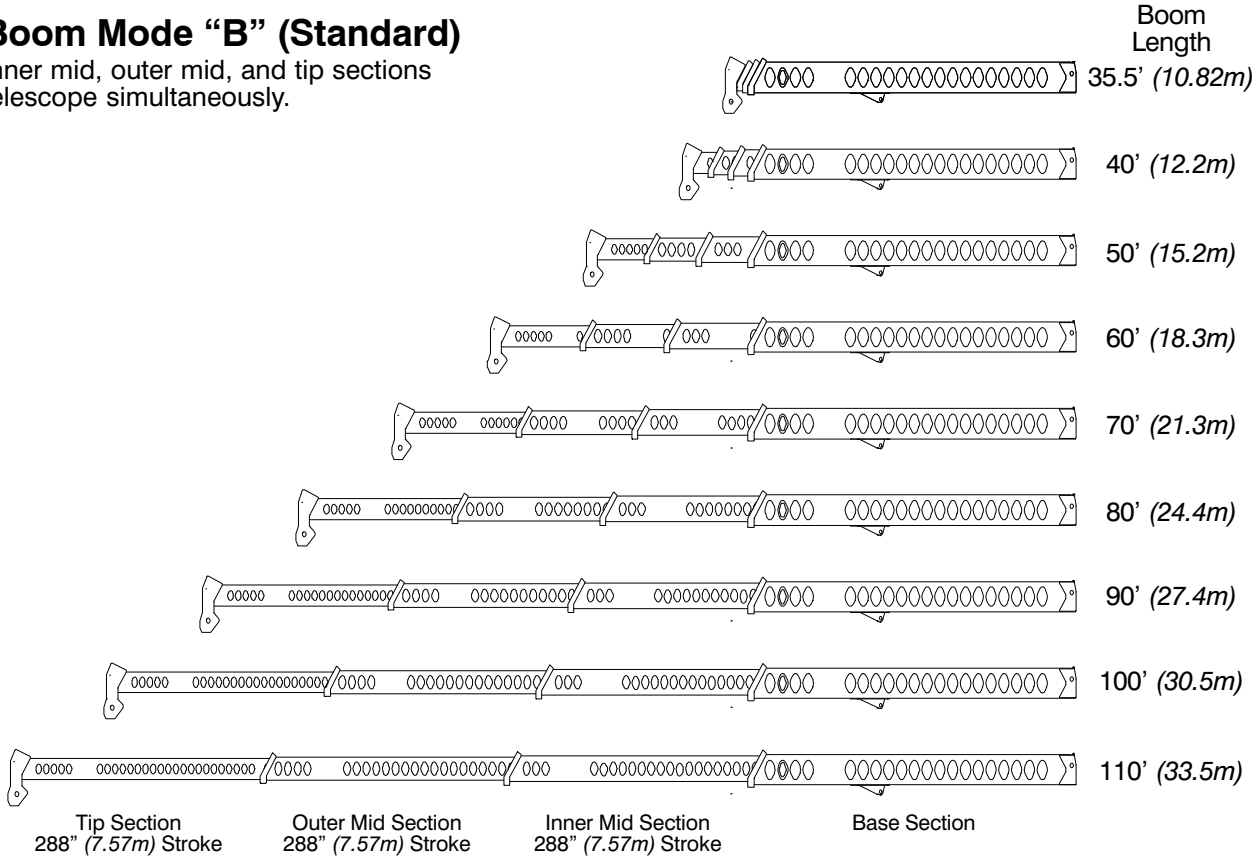
Boom Mode “A” (A–max)

Only inner mid section telescopes.

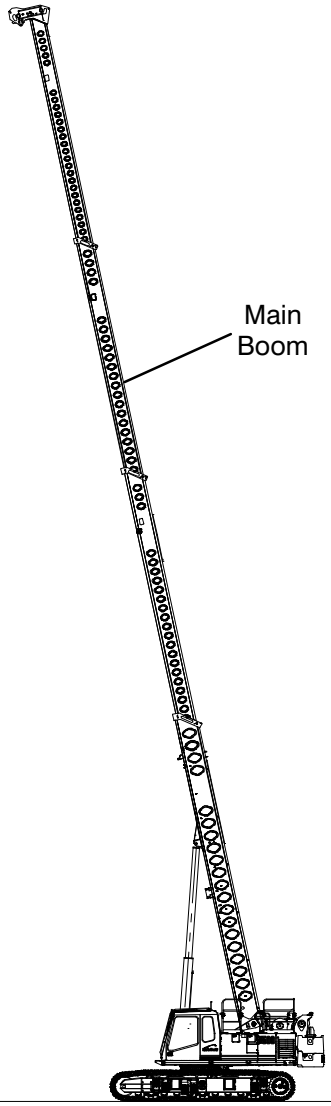


Boom Mode “B” (Standard)

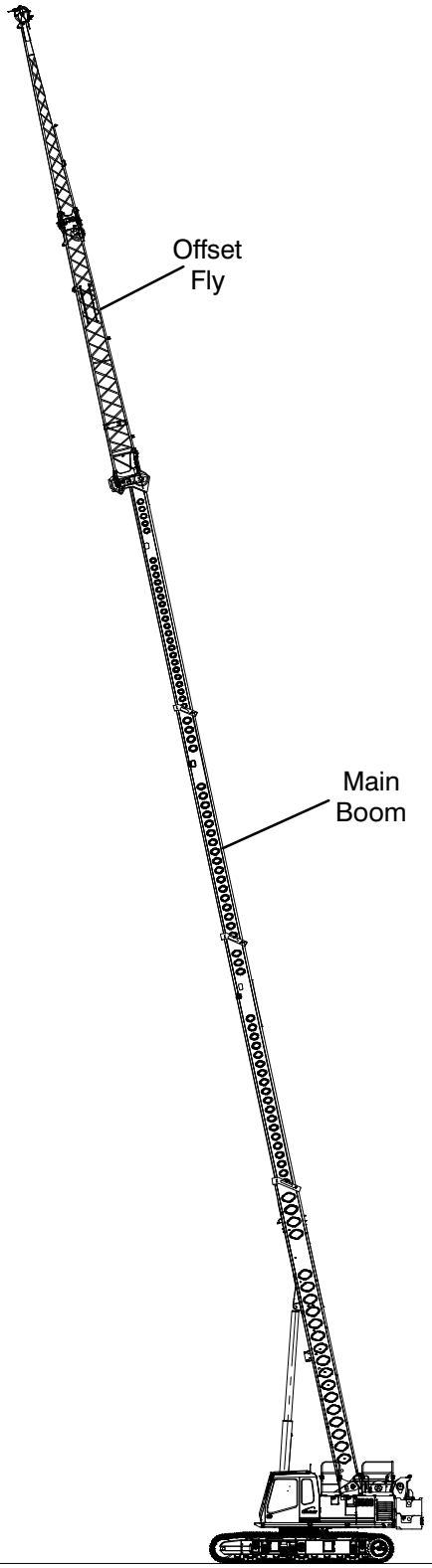
Inner mid, outer mid, and tip sections telescope simultaneously.



Attachments

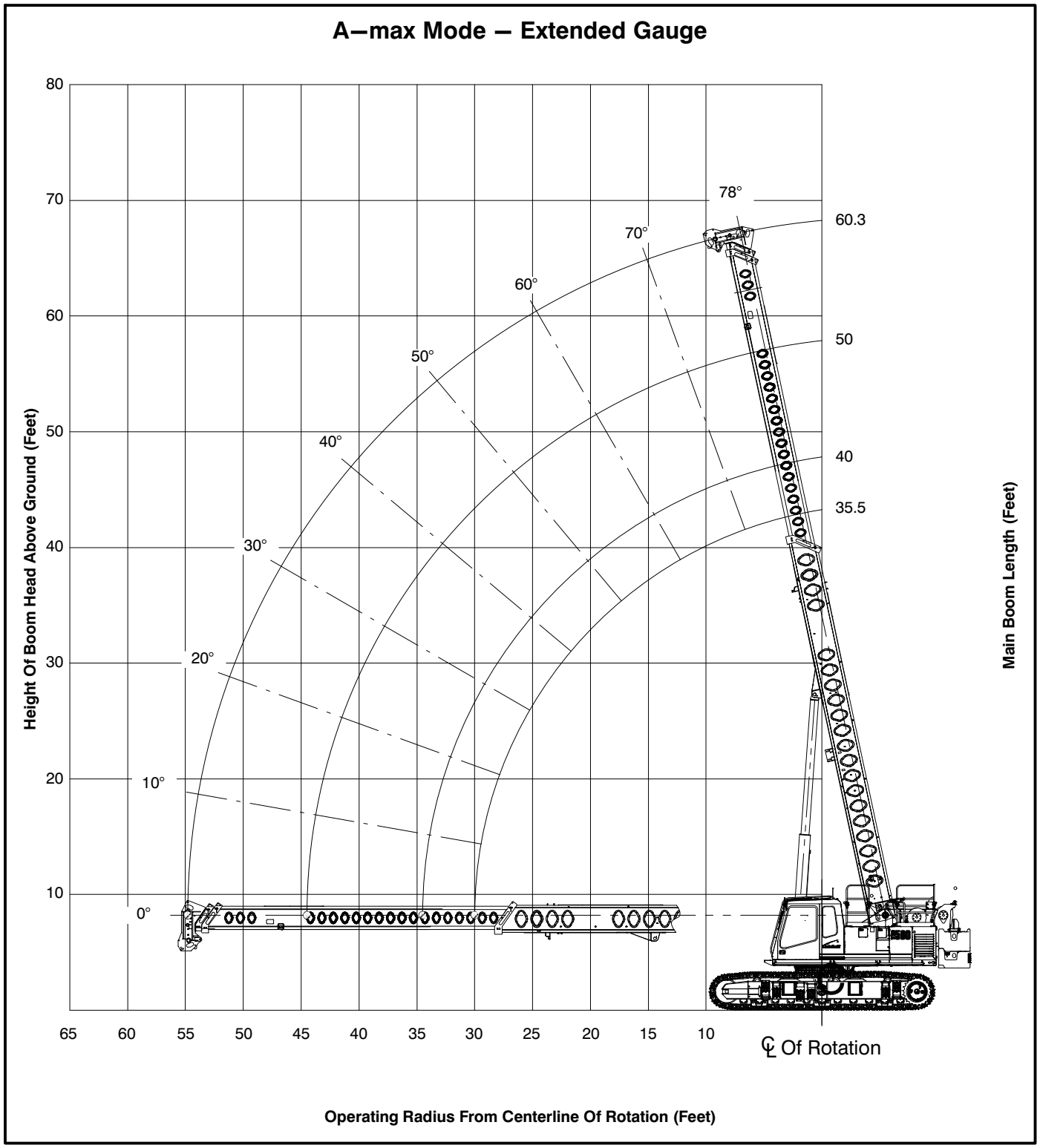


35.5—110 ft *(10.82—33.53m)* Main Boom

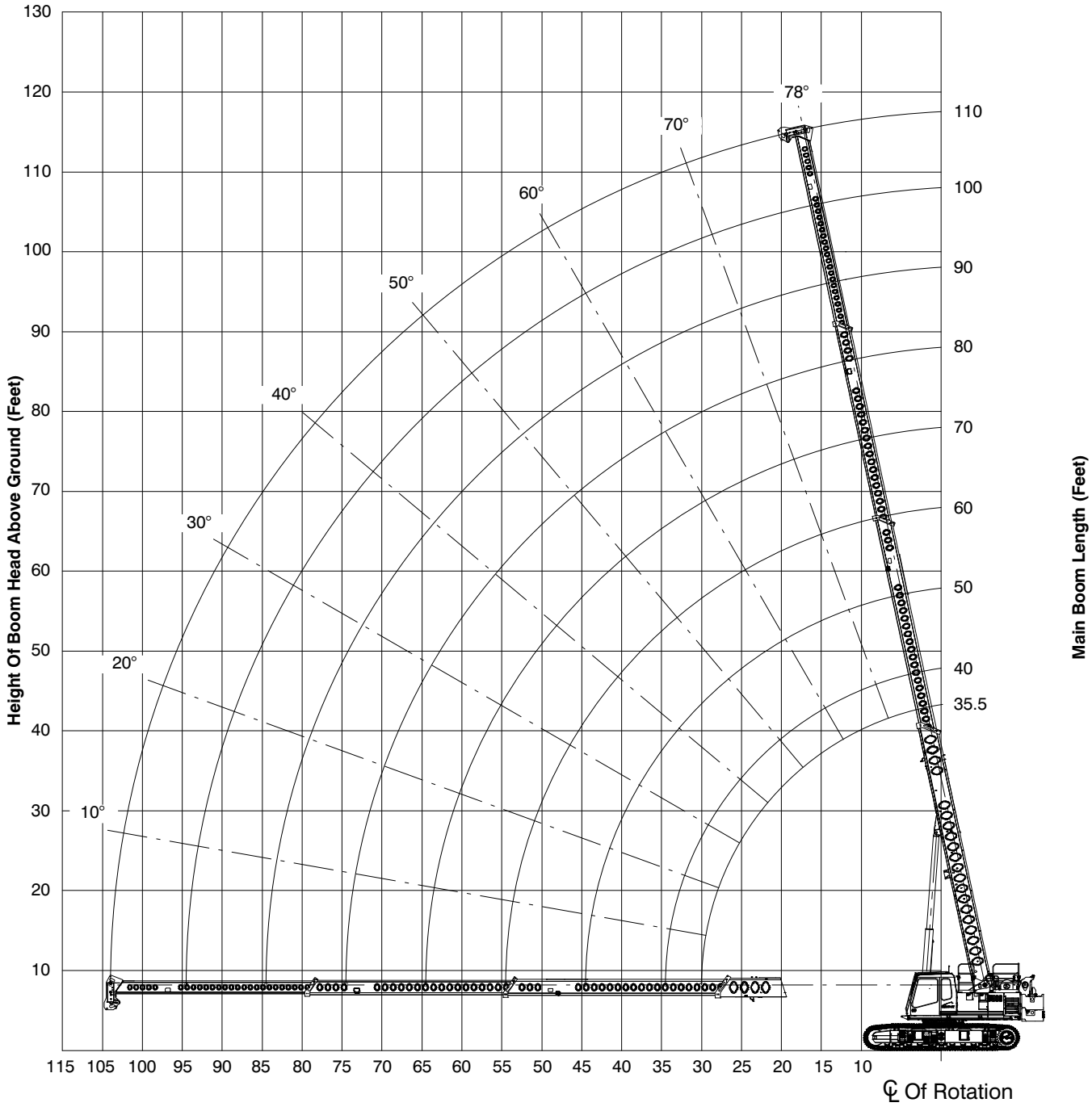


35.5—110 ft *(10.82—33.53m)* Main Boom With 28.5—51 ft *(8.69—15.54m)* Offset Fly

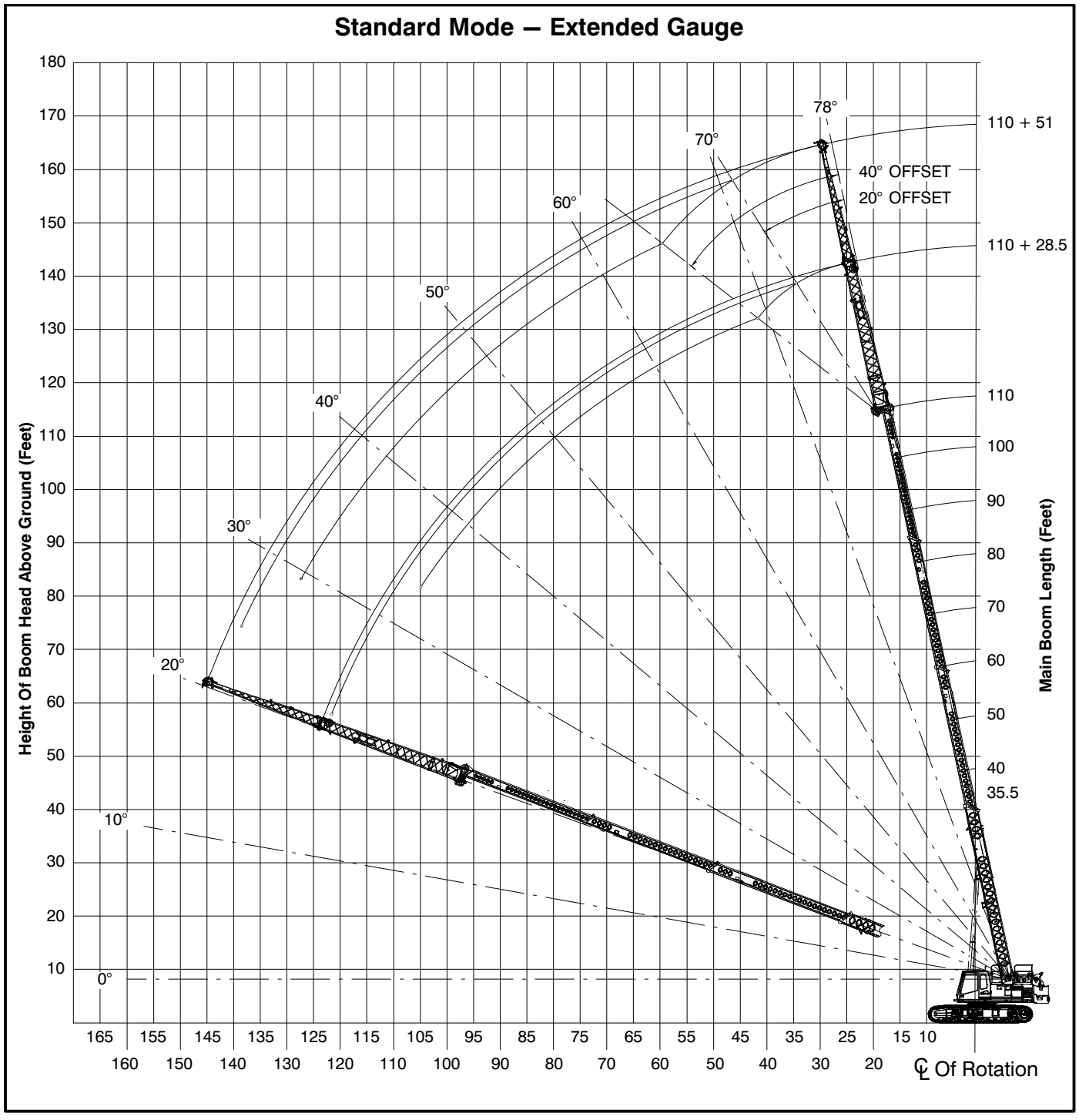
Main Boom Working Range Diagrams



Standard — Extended Gauge



Main Boom + Fly Working Range Diagrams



Main Boom Load Charts

Main Boom Lift Capacity Chart — 360° Rotation — Side Frames Extended Position
AB+0 [25,000 lb *(11 340kg)*] Counterweight
[All capacities are listed in kips (*mt*)]

Load Radius ft *(m)*	Boom Length ft *(m)*									Load Radius ft *(m)*
	35.5 *(10.8)*	40.0 *(12.2)*	50.0 *(15.2)*	60.0 *(18.3)*	70.0 *(21.3)*	80.0 *(24.4)*	90.0 *(27.4)*	100.0 *(30.5)*	110.0 *(33.5)*	
10.0 *(3.0)*	100.0 *(45.4)*	84.0 *(38.1)*	82.1 *(37.2)*							**10.0 *(3.0)***
12.0 *(3.7)*	88.1 *(40.0)*	84.0 *(38.1)*	79.0 *(35.8)*	53.2 *(24.1)*	39.0 *(17.7)*					**12.0 *(3.7)***
15.0 *(4.6)*	76.8 *(34.8)*	74.5 *(33.8)*	69.1 *(31.3)*	51.1 *(23.2)*	39.0 *(17.7)*	40.0 *(18.1)*				**15.0 *(4.6)***
20.0 *(6.1)*	47.0 *(21.3)*	46.8 *(21.2)*	46.2 *(21.0)*	42.1 *(19.1)*	39.0 *(17.7)*	37.8 *(17.1)*	31.2 *(14.2)*			**20.0 *(6.1)***
25.0 *(7.6)*	32.3 *(14.7)*	32.7 *(14.8)*	33.3 *(15.1)*	33.6 *(15.2)*	33.7 *(15.3)*	33.2 *(15.1)*	27.4 *(12.4)*	24.7 *(11.2)*	20.0 *(9.1)*	**25.0 *(7.6)***
30.0 *(9.1)*		24.2 *(11.0)*	24.8 *(11.2)*	25.2 *(11.4)*	25.3 *(11.5)*	25.4 *(11.5)*	24.2 *(11.0)*	21.7 *(9.8)*	19.9 *(9.0)*	**30.0 *(9.1)***
35.0 *(10.7)*			19.3 *(8.8)*	19.7 *(8.9)*	19.9 *(9.0)*	20.0 *(9.1)*	20.1 *(9.1)*	19.4 *(8.8)*	17.8 *(8.1)*	**35.0 *(10.7)***
40.0 *(12.2)*			15.4 *(7.0)*	15.8 *(7.2)*	16.0 *(7.3)*	16.2 *(7.3)*	16.3 *(7.4)*	16.3 *(7.4)*	16.0 *(7.3)*	**40.0 *(12.2)***
45.0 *(13.7)*				12.9 *(5.9)*	13.2 *(6.0)*	13.3 *(6.0)*	13.4 *(6.1)*	13.5 *(6.1)*	13.5 *(6.1)*	**45.0 *(13.7)***
50.0 *(15.2)*				10.7 *(4.9)*	11.0 *(5.0)*	11.2 *(5.1)*	11.2 *(5.1)*	11.3 *(5.1)*	11.3 *(5.1)*	**50.0 *(15.2)***
55.0 *(16.8)*					9.2 *(4.2)*	9.4 *(4.3)*	9.5 *(4.3)*	9.6 *(4.4)*	9.7 *(4.4)*	**55.0 *(16.8)***
60.0 *(18.3)*					7.8 *(3.5)*	8.0 *(3.6)*	8.1 *(3.7)*	8.2 *(3.7)*	8.3 *(3.8)*	**60.0 *(18.3)***
65.0 *(19.8)*						6.8 *(3.1)*	6.9 *(3.1)*	7.0 *(3.2)*	7.1 *(3.2)*	**65.0 *(19.8)***
70.0 *(21.3)*						5.8 *(2.6)*	5.9 *(2.7)*	6.0 *(2.7)*	6.1 *(2.8)*	**70.0 *(21.3)***
75.0 *(22.9)*							5.1 *(2.3)*	5.2 *(2.4)*	5.2 *(2.4)*	**75.0 *(22.9)***
80.0 *(24.4)*							4.3 *(2.0)*	4.4 *(2.0)*	4.5 *(2.0)*	**80.0 *(24.4)***
85.0 *(25.9)*								3.8 *(1.7)*	3.9 *(1.8)*	**85.0 *(25.9)***
90.0 *(27.4)*								3.2 *(1.5)*	3.3 *(1.5)*	**90.0 *(27.4)***
95.0 *(29.0)*									2.8 *(1.3)*	**95.0 *(29.0)***
100.0 *(30.5)*									2.4 *(1.1)*	**100.0 *(30.5)***

*** 51 metric ton base rating obtained @ 2.5 meters**

This material is supplied for reference use only. Operator must refer to in—cab Crane Rating Manual and Operator's Manual to determine allowable crane lifting capacities and assembly and operating procedures.

Main Boom Lift Capacity Chart — 360° Rotation — Side Frames Intermediate Position
ABC+A [36,000 lb *(16 329kg)*] Counterweight
[All capacities are listed in kips (*mt*)]

Load Radius ft *(m)*	Boom Length ft *(m)*									Load Radius ft *(m)*
	35.5 *(10.8)*	40.0 *(12.2)*	50.0 *(15.2)*	60.0 *(18.3)*	70.0 *(21.3)*	80.0 *(24.4)*	90.0 *(27.4)*	100.0 *(30.5)*	110.0 *(33.5)*	
10.0 *(3.0)*	100.0 *(45.4)*	84.0 *(38.1)*	82.1 *(37.2)*							**10.0 *(3.0)***
12.0 *(3.7)*	88.1 *(40.0)*	84.0 *(38.1)*	79.0 *(35.8)*	53.2 *(24.1)*	39.0 *(17.7)*					**12.0 *(3.7)***
15.0 *(4.6)*	76.8 *(34.8)*	74.5 *(33.8)*	69.1 *(31.3)*	51.1 *(23.2)*	39.0 *(17.7)*	40.0 *(18.1)*				**15.0 *(4.6)***
20.0 *(6.1)*	54.4 *(24.7)*	54.2 *(24.6)*	53.6 *(24.3)*	42.1 *(19.1)*	39.0 *(17.7)*	37.8 *(17.1)*	31.2 *(14.2)*			**20.0 *(6.1)***
25.0 *(7.6)*	37.6 *(17.1)*	38.1 *(17.3)*	38.5 *(17.5)*	38.5 *(17.5)*	39.0 *(17.7)*	33.2 *(15.1)*	27.4 *(12.4)*	24.7 *(11.2)*	20.0 *(9.1)*	**25.0 *(7.6)***
30.0 *(9.1)*		28.4 *(12.9)*	29.1 *(13.2)*	29.4 *(13.3)*	29.6 *(13.4)*	29.6 *(13.4)*	24.2 *(11.0)*	21.7 *(9.8)*	19.9 *(9.0)*	**30.0 *(9.1)***
35.0 *(10.7)*			22.8 *(10.3)*	23.1 *(10.5)*	23.4 *(10.6)*	23.4 *(10.6)*	21.4 *(9.7)*	19.4 *(8.8)*	17.8 *(8.1)*	**35.0 *(10.7)***
40.0 *(12.2)*			18.4 *(8.3)*	18.8 *(8.5)*	19.0 *(8.6)*	19.2 *(8.7)*	19.2 *(8.7)*	17.4 *(7.9)*	16.0 *(7.3)*	**40.0 *(12.2)***
45.0 *(13.7)*				15.5 *(7.0)*	15.8 *(7.2)*	15.9 *(7.2)*	16.0 *(7.3)*	15.7 *(7.1)*	14.4 *(6.5)*	**45.0 *(13.7)***
50.0 *(15.2)*				13.0 *(5.9)*	13.2 *(6.0)*	13.4 *(6.1)*	13.5 *(6.1)*	13.6 *(6.2)*	13.1 *(5.9)*	**50.0 *(15.2)***
55.0 *(16.8)*					11.3 *(5.1)*	11.4 *(5.2)*	11.5 *(5.2)*	11.6 *(5.3)*	11.7 *(5.3)*	**55.0 *(16.8)***
60.0 *(18.3)*					9.7 *(4.4)*	9.8 *(4.4)*	10.0 *(4.5)*	10.1 *(4.6)*	10.1 *(4.6)*	**60.0 *(18.3)***
65.0 *(19.8)*						8.5 *(3.9)*	8.6 *(3.9)*	8.7 *(3.9)*	8.8 *(4.0)*	**65.0 *(19.8)***
70.0 *(21.3)*						7.4 *(3.4)*	7.5 *(3.4)*	7.6 *(3.4)*	7.7 *(3.5)*	**70.0 *(21.3)***
75.0 *(22.9)*							6.5 *(2.9)*	6.6 *(3.0)*	6.7 *(3.0)*	**75.0 *(22.9)***
80.0 *(24.4)*							5.7 *(2.6)*	5.8 *(2.6)*	5.9 *(2.7)*	**80.0 *(24.4)***
85.0 *(25.9)*								5.1 *(2.3)*	5.1 *(2.3)*	**85.0 *(25.9)***
90.0 *(27.4)*								4.4 *(2.0)*	4.5 *(2.0)*	**90.0 *(27.4)***
95.0 *(29.0)*									3.9 *(1.8)*	**95.0 *(29.0)***
100.0 *(30.5)*									3.4 *(1.5)*	**100.0 *(30.5)***

This material is supplied for reference use only. Operator must refer to in—cab Crane Rating Manual and Operator's Manual to determine allowable crane lifting capacities and assembly and operating procedures.

Main Boom + Fly Load Charts

90 ft *(27.4m)* Main Boom + Fly — 360° Rotation — Standard Mode — Side Frames Extended Position
AB+0 [25,000 lb *(11 340kg)*] Counterweight
[All capacities are listed in kips (*mt*)]

Load Radius ft *(m)*	28.25 ft Manual Offset Fly			51 ft Manual Offset Fly			Load Radius ft *(m)*
	2°	20°	40°	2°	20°	40°	
30 *(9.1)*	16.7 *(7.6)*						30 *(9.1)*
35 *(10.7)*	15.5 *(7.0)*			9.7 *(4.4)*			35 *(10.7)*
40 *(12.2)*	14.5 *(6.6)*	10.5 *(4.8)*		8.6 *(3.9)*			40 *(12.2)*
45 *(13.7)*	13.5 *(6.1)*	9.9 *(4.5)*	7.9 *(3.6)*	8.1 *(3.7)*			45 *(13.7)*
50 *(15.2)*	12.0 *(5.4)*	9.4 *(4.3)*	7.6 *(3.4)*	7.5 *(3.4)*	5.4 *(2.4)*		50 *(15.2)*
55 *(16.8)*	10.4 *(4.7)*	8.9 *(4.0)*	7.4 *(3.4)*	7.0 *(3.2)*	5.1 *(2.3)*		55 *(16.8)*
60 *(18.3)*	8.9 *(4.0)*	8.7 *(3.9)*	7.2 *(3.3)*	6.5 *(2.9)*	4.9 *(2.2)*		60 *(18.3)*
65 *(19.8)*	7.7 *(3.5)*	8.2 *(3.7)*	7.0 *(3.2)*	6.1 *(2.8)*	4.6 *(2.1)*	3.7 *(1.7)*	65 *(19.8)*
70 *(21.3)*	6.7 *(3.0)*	7.2 *(3.3)*	6.8 *(3.1)*	5.7 *(2.6)*	4.4 *(2.0)*	3.5 *(1.6)*	70 *(21.3)*
75 *(22.9)*	5.9 *(2.7)*	6.2 *(2.8)*	6.5 *(2.9)*	5.4 *(2.4)*	4.2 *(1.9)*	3.4 *(1.5)*	75 *(22.9)*
80 *(24.4)*	5.1 *(2.3)*	5.5 *(2.5)*	5.7 *(2.6)*	5.1 *(2.3)*	4.0 *(1.8)*	3.3 *(1.5)*	80 *(24.4)*
85 *(25.9)*	4.5 *(2.0)*	4.8 *(2.2)*	4.9 *(2.2)*	4.8 *(2.2)*	3.9 *(1.8)*	3.3 *(1.5)*	85 *(25.9)*
90 *(27.4)*	3.9 *(1.8)*	4.1 *(1.9)*	4.3 *(2.0)*	4.4 *(2.0)*	3.7 *(1.7)*	3.2 *(1.5)*	90 *(27.4)*
95 *(29.0)*	3.4 *(1.5)*	3.6 *(1.6)*	3.7 *(1.7)*	3.9 *(1.8)*	3.6 *(1.6)*	3.1 *(1.4)*	95 *(29.0)*
100 *(30.5)*	2.9 *(1.3)*	3.1 *(1.4)*		3.4 *(1.5)*	3.5 *(1.6)*	3.1 *(1.4)*	100 *(30.5)*
105 *(32.0)*	2.5 *(1.1)*	2.6 *(1.2)*		3.0 *(1.4)*	3.4 *(1.5)*	3.1 *(1.4)*	105 *(32.0)*
110 *(33.5)*	2.2 *(1.0)*			2.7 *(1.2)*	3.0 *(1.4)*	3.0 *(1.4)*	110 *(33.5)*
115 *(35.1)*				2.3 *(1.0)*	2.6 *(1.2)*	2.7 *(1.2)*	115 *(35.1)*
120 *(36.6)*				2.0 *(0.9)*	2.2 *(1.0)*		120 *(36.6)*
125 *(38.1)*				1.8 *(0.8)*	1.9 *(0.9)*		125 *(38.1)*
130 *(39.6)*				1.5 *(0.7)*	1.6 *(0.7)*		130 *(39.6)*
135 *(41.1)*				1.3 *(0.6)*			135 *(41.1)*

This material is supplied for reference use only. Operator must refer to in—cab Crane Rating Manual and Operator's Manual to determine allowable crane lifting capacities and assembly and operating procedures.

110 ft *(33.5m)* Main Boom + Fly — 360° Rotation — Standard Mode — Side Frames Extended Position
AB+0 [25,000 lb *(11 340kg)*] Counterweight
[All capacities are listed in kips (*mt*)]

Load Radius ft *(m)*	28.25 ft Manual Offset Fly			51 ft Manual Offset Fly			Load Radius ft *(m)*
	2°	20°	40°	2°	20°	40°	
35 *(10.7)*	11.5 *(5.2)*						35 *(10.7)*
40 *(12.2)*	11.5 *(5.2)*						40 *(12.2)*
45 *(13.7)*	10.9 *(4.9)*	9.8 *(4.4)*		6.6 *(3.0)*			45 *(13.7)*
50 *(15.2)*	10.0 *(4.5)*	9.0 *(4.1)*	7.5 *(3.4)*	6.6 *(3.0)*			50 *(15.2)*
55 *(16.8)*	9.2 *(4.2)*	8.4 *(3.8)*	7.4 *(3.4)*	6.6 *(3.0)*			55 *(16.8)*
60 *(18.3)*	8.5 *(3.9)*	7.8 *(3.5)*	7.2 *(3.3)*	6.4 *(2.9)*	4.9 *(2.2)*		60 *(18.3)*
65 *(19.8)*	7.6 *(3.4)*	7.3 *(3.3)*	6.9 *(3.1)*	6.1 *(2.8)*	4.7 *(2.1)*		65 *(19.8)*
70 *(21.3)*	6.6 *(3.0)*	6.8 *(3.1)*	6.5 *(2.9)*	5.6 *(2.5)*	4.5 *(2.0)*		70 *(21.3)*
75 *(22.9)*	5.7 *(2.6)*	6.1 *(2.8)*	6.1 *(2.8)*	5.3 *(2.4)*	4.3 *(2.0)*	3.5 *(1.6)*	75 *(22.9)*
80 *(24.4)*	5.0 *(2.3)*	5.4 *(2.4)*	5.7 *(2.6)*	4.9 *(2.2)*	4.1 *(1.9)*	3.4 *(1.5)*	80 *(24.4)*
85 *(25.9)*	4.3 *(2.0)*	4.7 *(2.1)*	4.9 *(2.2)*	4.6 *(2.1)*	4.0 *(1.8)*	3.3 *(1.5)*	85 *(25.9)*
90 *(27.4)*	3.8 *(1.7)*	4.1 *(1.9)*	4.3 *(2.0)*	4.2 *(1.9)*	3.9 *(1.8)*	3.2 *(1.5)*	90 *(27.4)*
95 *(29.0)*	3.3 *(1.5)*	3.5 *(1.6)*	3.7 *(1.7)*	3.7 *(1.7)*	3.7 *(1.7)*	3.2 *(1.5)*	95 *(29.0)*
100 *(30.5)*	2.8 *(1.3)*	3.0 *(1.4)*	3.2 *(1.5)*	3.2 *(1.5)*	3.6 *(1.6)*	3.1 *(1.4)*	100 *(30.5)*
105 *(32.0)*	2.4 *(1.1)*	2.6 *(1.2)*	2.7 *(1.2)*	2.8 *(1.3)*	3.2 *(1.5)*	3.1 *(1.4)*	105 *(32.0)*
110 *(33.5)*	2.0 *(0.9)*	2.2 *(1.0)*	2.3 *(1.0)*	2.4 *(1.1)*	2.8 *(1.3)*	3.0 *(1.4)*	110 *(33.5)*
115 *(35.1)*	1.7 *(0.8)*	1.8 *(0.8)*		2.1 *(1.0)*	2.5 *(1.1)*	2.7 *(1.2)*	115 *(35.1)*
120 *(36.6)*	1.4 *(0.6)*	1.5 *(0.7)*		1.8 *(0.8)*	2.1 *(1.0)*	2.3 *(1.0)*	120 *(36.6)*
125 *(38.1)*	1.1 *(0.5)*	1.2 *(0.5)*		1.5 *(0.7)*	1.8 *(0.8)*	2.0 *(0.9)*	125 *(38.1)*
130 *(39.6)*				1.3 *(0.6)*	1.5 *(0.7)*	1.6 *(0.7)*	130 *(39.6)*
135 *(41.1)*				1.0 *(0.5)*	1.2 *(0.5)*	1.3 *(0.6)*	135 *(41.1)*

This material is supplied for reference use only. Operator must refer to in—cab Crane Rating Manual and Operator's Manual to determine allowable crane lifting capacities and assembly and operating procedures.

90 ft *(27.4m)* Main Boom + Fly — 360° Rotation — Standard Mode — Side Frames Extended Position
ABC+A [36,000 lb *(16 329kg)*] Counterweight
[All capacities are listed in kips (*mt*)]

Load Radius ft *(m)*	28.25 ft Manual Offset Fly			51 ft Manual Offset Fly			Load Radius ft *(m)*
	2°	20°	40°	2°	20°	40°	
30 *(9.1)*	16.7 *(7.6)*						30 *(9.1)*
35 *(10.7)*	15.5 *(7.0)*			9.7 *(4.4)*			35 *(10.7)*
40 *(12.2)*	14.5 *(6.6)*	10.5 *(4.8)*		8.6 *(3.9)*			40 *(12.2)*
45 *(13.7)*	13.5 *(6.1)*	9.9 *(4.5)*	7.9 *(3.6)*	8.1 *(3.7)*			45 *(13.7)*
50 *(15.2)*	12.4 *(5.6)*	9.4 *(4.3)*	7.6 *(3.4)*	7.5 *(3.4)*	5.4 *(2.4)*		50 *(15.2)*
55 *(16.8)*	11.4 *(5.2)*	8.9 *(4.0)*	7.4 *(3.4)*	7.0 *(3.2)*	5.1 *(2.3)*		55 *(16.8)*
60 *(18.3)*	10.5 *(4.8)*	8.7 *(3.9)*	7.2 *(3.3)*	6.5 *(2.9)*	4.9 *(2.2)*		60 *(18.3)*
65 *(19.8)*	9.4 *(4.3)*	8.3 *(3.8)*	7.0 *(3.2)*	6.1 *(2.8)*	4.6 *(2.1)*	3.7 *(1.7)*	65 *(19.8)*
70 *(21.3)*	8.3 *(3.8)*	8.0 *(3.6)*	6.8 *(3.1)*	5.7 *(2.6)*	4.4 *(2.0)*	3.5 *(1.6)*	70 *(21.3)*
75 *(22.9)*	7.3 *(3.3)*	7.7 *(3.5)*	6.7 *(3.0)*	5.4 *(2.4)*	4.2 *(1.9)*	3.4 *(1.5)*	75 *(22.9)*
80 *(24.4)*	6.5 *(2.9)*	6.8 *(3.1)*	6.6 *(3.0)*	5.1 *(2.3)*	4.0 *(1.8)*	3.3 *(1.5)*	80 *(24.4)*
85 *(25.9)*	5.7 *(2.6)*	6.0 *(2.7)*	6.2 *(2.8)*	4.8 *(2.2)*	3.9 *(1.8)*	3.3 *(1.5)*	85 *(25.9)*
90 *(27.4)*	5.1 *(2.3)*	5.3 *(2.4)*	5.5 *(2.5)*	4.5 *(2.0)*	3.7 *(1.7)*	3.2 *(1.5)*	90 *(27.4)*
95 *(29.0)*	4.5 *(2.0)*	4.7 *(2.1)*	4.8 *(2.2)*	4.3 *(2.0)*	3.6 *(1.6)*	3.1 *(1.4)*	95 *(29.0)*
100 *(30.5)*	4.0 *(1.8)*	4.2 *(1.9)*		4.1 *(1.9)*	3.5 *(1.6)*	3.1 *(1.4)*	100 *(30.5)*
105 *(32.0)*	3.5 *(1.6)*	3.7 *(1.7)*		3.9 *(1.8)*	3.4 *(1.5)*	3.1 *(1.4)*	105 *(32.0)*
110 *(33.5)*	3.1 *(1.4)*			3.6 *(1.6)*	3.3 *(1.5)*	3.0 *(1.4)*	110 *(33.5)*
115 *(35.1)*				3.3 *(1.5)*	3.2 *(1.5)*	3.0 *(1.4)*	115 *(35.1)*
120 *(36.6)*				2.9 *(1.3)*	3.1 *(1.4)*	3.0 *(1.4)*	120 *(36.6)*
125 *(38.1)*				2.6 *(1.2)*	2.8 *(1.3)*		125 *(38.1)*
130 *(39.6)*				2.3 *(1.0)*	2.4 *(1.1)*		130 *(39.6)*
135 *(41.1)*				2.0 *(0.9)*			135 *(41.1)*

This material is supplied for reference use only. Operator must refer to in—cab Crane Rating Manual and Operator's Manual to determine allowable crane lifting capacities and assembly and operating procedures.

110 ft *(33.5m)* Main Boom + Fly — 360° Rotation — Standard Mode — Side Frames Extended Position
ABC+A [36,000 lb *(16 329kg)*] Counterweight
[All capacities are listed in kips (*mt*)]

Load Radius ft *(m)*	28.25 ft Manual Offset Fly			51 ft Manual Offset Fly			Load Radius ft *(m)*
	2°	20°	40°	2°	20°	40°	
35 *(10.7)*	11.5 *(5.2)*						35 *(10.7)*
40 *(12.2)*	11.5 *(5.2)*						40 *(12.2)*
45 *(13.7)*	10.9 *(4.9)*	9.8 *(4.4)*		6.6 *(3.0)*			45 *(13.7)*
50 *(15.2)*	10.0 *(4.5)*	9.0 *(4.1)*	7.5 *(3.4)*	6.6 *(3.0)*			50 *(15.2)*
55 *(16.8)*	9.2 *(4.2)*	8.4 *(3.8)*	7.4 *(3.4)*	6.6 *(3.0)*			55 *(16.8)*
60 *(18.3)*	8.5 *(3.9)*	7.8 *(3.5)*	7.2 *(3.3)*	6.4 *(2.9)*	4.9 *(2.2)*		60 *(18.3)*
65 *(19.8)*	7.8 *(3.5)*	7.3 *(3.3)*	6.9 *(3.1)*	6.1 *(2.8)*	4.7 *(2.1)*		65 *(19.8)*
70 *(21.3)*	7.3 *(3.3)*	6.8 *(3.1)*	6.5 *(2.9)*	5.6 *(2.5)*	4.5 *(2.0)*		70 *(21.3)*
75 *(22.9)*	6.8 *(3.1)*	6.4 *(2.9)*	6.1 *(2.8)*	5.3 *(2.4)*	4.3 *(2.0)*	3.5 *(1.6)*	75 *(22.9)*
80 *(24.4)*	6.3 *(2.9)*	6.0 *(2.7)*	5.8 *(2.6)*	4.9 *(2.2)*	4.1 *(1.9)*	3.4 *(1.5)*	80 *(24.4)*
85 *(25.9)*	5.6 *(2.5)*	5.7 *(2.6)*	5.5 *(2.5)*	4.6 *(2.1)*	4.0 *(1.8)*	3.3 *(1.5)*	85 *(25.9)*
90 *(27.4)*	4.9 *(2.2)*	5.3 *(2.4)*	5.2 *(2.4)*	4.3 *(2.0)*	3.9 *(1.8)*	3.2 *(1.5)*	90 *(27.4)*
95 *(29.0)*	4.4 *(2.0)*	4.7 *(2.1)*	4.8 *(2.2)*	4.1 *(1.9)*	3.7 *(1.7)*	3.2 *(1.5)*	95 *(29.0)*
100 *(30.5)*	3.9 *(1.8)*	4.1 *(1.9)*	4.3 *(2.0)*	3.8 *(1.7)*	3.6 *(1.6)*	3.1 *(1.4)*	100 *(30.5)*
105 *(32.0)*	3.4 *(1.5)*	3.6 *(1.6)*	3.7 *(1.7)*	3.5 *(1.6)*	3.4 *(1.5)*	3.1 *(1.4)*	105 *(32.0)*
110 *(33.5)*	3.0 *(1.4)*	3.2 *(1.5)*	3.2 *(1.5)*	3.2 *(1.5)*	3.2 *(1.5)*	3.0 *(1.4)*	110 *(33.5)*
115 *(35.1)*	2.6 *(1.2)*	2.8 *(1.3)*		2.9 *(1.3)*	3.0 *(1.4)*	2.9 *(1.3)*	115 *(35.1)*
120 *(36.6)*	2.3 *(1.0)*	2.4 *(1.1)*		2.6 *(1.2)*	2.8 *(1.3)*	2.8 *(1.3)*	120 *(36.6)*
125 *(38.1)*	2.0 *(0.9)*	2.0 *(0.9)*		2.3 *(1.0)*	2.5 *(1.1)*	2.6 *(1.2)*	125 *(38.1)*
130 *(39.6)*				2.1 *(1.0)*	2.3 *(1.0)*	2.4 *(1.1)*	130 *(39.6)*
135 *(41.1)*				1.8 *(0.8)*	2.0 *(0.9)*	2.1 *(1.0)*	135 *(41.1)*

This material is supplied for reference use only. Operator must refer to in—cab Crane Rating Manual and Operator's Manual to determine allowable crane lifting capacities and assembly and operating procedures.

MICHELS®
FOUNDATIONS

TAB 4

PACO VENTURES, LLC

2296 Meyers Ave., Escondido, CA 92029 (760) 748-6653
Mike Hagy Mobile - (805) 746-6965

Michael Hagy - Lead Foundation Slurry Engineering Consultant
ADSC/DFI Member

Mike has operated as a professional slurry consultant on the West Coast for almost 30 years designing calculated site specific slurry programs and has consulted on a varied array of drilling projects within the foundation drilling industry. He has on the job, technical expertise in dealing with various geologic formations, the problems they pose and the solutions to overcome them. Some of his skills lie in assessment and planning, soils analysis, calculating and designing site specific slurry system programs, estimations, consulting with D.O.T. engineers/inspectors, conducting drilling schools & classroom instruction including ADSC/Union Local 3, on-site slurry preparation/mixing, drilling procedures, trouble shooting, slurry testing procedures, analysis, recycling and disposal, slurry construction/management training. Mike chaired the 2017 Assoc. of Drilled Shaft Contractors ADSC National, Annual Slurry School in St. Petersburg, FL.

Mike has designed calculated slurry programs and worked with most all Category 1-2 as well as 3-4 drilling contractors on many major bridge, structures, & highway construction projects on the West Coast & Western Canada over the years. Mike is currently leading Western States Business Development and is the Lead Slurry Engineering Consultant with PACO Ventures (Pacific American Commercial Company) based out of Seattle, WA. Mike is based out of Ventura, CA.

SAMPLE OF PROJECTS - SLURRY PROGRAMS - SALES - CONSULTATION

Hood Canal Project – Seattle, WA
http://www.wsdot.wa.gov/projects/sr104hoodcanalbridgeeast/
Richmond/San Rafael Bridge Project– Bay Area, CA
www.dot.ca.gov/hq/esc/tollbridge/Rich-SR/Rich-SR.html
Benicia/Martinez Bridge Project – Bay Area, CA
http://www.dot.ca.gov/dist4/benicia/
Bay Bridge Project – San Francisco/Oakland CA
http://www.baybridgeinfo.org/
Port Mann Bridge Project – Vancouver, BC
http://www.pmh1project.com/
Manette Bridge Replacement Project, Bremerton, WA
http://www.mansonconstruction.com/manette-bridge-replacement/
Transbay Transit Center Project – San Francisco, CA
http://transbaycenter.org/
Schuyler Heim Bridge Replacement Project, Long Beach, CA
http://www.newgdbridge.com/
SR520 Bridge Replacement Project-Seattle, WA
http://www.wsdot.wa.gov/projects/SR520Bridge/
San Francisco Central Subway Project, San Francisco, CA
http://www.hsr.ca.gov/
California High Speed Rail Project, San Joaquin Valley, CA
http://www.hsr.ca.gov/
The Maline Creek Tunnel Storage Facility, St. Louis MO
http://www.projectclearstl.org/build-system-improvements/maline-creek-storage-facility/
New Los Angeles Rams Football Stadium, Inglewood, CA
http://www.cnn.com/2016/01/19/architecture/new-nfl-stadium-los-angeles/
Metro Purple Line Subway Extension, Beverly Hills, Westwood, Los Angeles, CA
https://www.metro.net/projects/westside/

For consultation or design of a Site-Specific Slurry System Program or training contact

Mike Hagy @ (805) 746-6965 Mike@PacoEquip.com

SLURRY BUSTER™ DRY

SHORE PAC POLYMER SLURRY BREAKER

DESCRIPTION

SLURRY BUSTER DRY is an industrial grade oxidizing agent used to breakdown SHORE PAC polymer slurry. This white granular solid dissolves completely when applied to SHORE PAC polymer slurry. The active ingredient is a powerful class III oxidizer that ensures rapid and complete slurry degradation. SLURRY BUSTER DRY is supplied in plastic re-sealable pails. SLURRY BUSTER DRY is a highly effective clean-up solution.

RECOMMENDED USE

SLURRY BUSTER DRY mixes rapidly into the drilling slurry and breaks the polymer backbone through an oxidation reaction. After treatment with SLURRY BUSTER DRY all that remains is water; ready for convenient disposal. SLURRY BUSTER DRY is designed to be added at the tank or waste pit but never to the excavation.

CHARACTERISTICS

- No freeze concerns
- Maximum strength at 65% active ingredients
- Easy-to-use re-sealable pails
- Breaks slurry faster for quick, efficient disposal
- Soluble in water
- Will not decompose when stored of properly

TYPICAL PROPERTIES

Physical State:	Solid Granular
Appearance:	White to off white
Odor:	Chlorine-like
pH:	10.4 - 10.8 (1% solution in neutral, distilled water) (@ 25° C)

MIXING AND APPLICATION

15 lbs of SLURRY BUSTER DRY per 10,000 gallons SHORE PAC polymer slurry. Circulate entire volume of slurry by pumping to ensure complete oxidation of polymer molecules.

Note: For high viscosity slurry or slurry that has been pre-treated with DE-CHLOR a higher dosage of SLURRY BUSTER DRY may be necessary.

PACKAGING:

15 lb pail, 36 per pallet. All pallets are plastic-wrapped..

North America: 847.851.1800 | 800.527.9948

UPDATED: OCTOBER 2013

TDS_SLURRYBUSTER-DRY_AM_EN_201310_V1

CETCO®

An AMCOL Company

www.CETCO.com

USE OF SHORE PAC® POLYMER SLURRY

IN SLURRY-DISPLACED FOUNDATION CONSTRUCTION

North America: 847.851.1800 | 800.527.9948 | www.CETCO.com

UPDATED: FEBRUARY 2019

FORM: CETCO - DRILLING PRODUCTS SHORE PAC DRILLING & MIXING GUIDE

INTRODUCTION

This specification provides direction in the proper use of SHORE PAC® and its additives while improving standardization, quality, and performance in the practice of slurry-displaced deep foundation construction. This document ensures that engineers and engineering geologists can confidently predict the load carrying capacity of the piling being constructed using an approved slurry, and to ensure that an approved slurry is not detrimental to the structural capacity or service life of the piling.

ADVANTAGES

The advantages of using high performance polymer slurry over mineral slurry yield multiple benefits, which improve construction economics in many ways. SHORE PAC saves time and money while improving construction quality and reducing defects.

- ►Controls fluid loss in sands and gravels. Stabilizes excavations
- ►Highly concentrated. Very small quantities required
- ►Improves productivity of machines and crews
- ►Reduces chipping and cleaning of poured concrete
- ►Reduces or eliminates disposal costs. Product is environmentally safe
- ►Reduces transport costs and storage space requirements
- ►Requires less mixing/processing equipment, reducing capital investment, jobsite congestion, and fuel costs

SCOPE

This specification covers the use of polymer stabilizing support fluids ("slurry") based on SHORE PAC, an easy mixing, water-soluble, polymer supplied as a free-flowing granular material. SHORE PAC earth-reinforcing fluid is designed for use in the construction of bored piles by the slurry-displacement method.

SELECTION OF POLYMER SLURRY MATERIALS

The principal polymer is SHORE PAC, manufactured by CETCO. Additives which have been certified by the manufacturer (CETCO) may be used with approval of the engineer and in accordance with the manufacturer's recommendations. The strict quality control guidelines set forth by the California Department of Transportation (CALTRANS) requirements for approval of SHORE PAC polymer drilling slurry have been applied to ensure the use of proven materials and techniques.

SHORE PAC POLYMER DOSAGE AND VISCOSITY

SHORE PAC is an easy mixing, water-soluble, polymer supplied as a granular material. SHORE PAC is designed for preparation of viscous earth-reinforcing fluids or slurries for a variety of drilling, trenching, and walling applications in the geo-construction industry.

1. Pre-treat make-up water with SODA ASH 6 lbs per 1,000 gallons make-up water for a pH of 8-10. Pre-treat make-up water with DE-CHLOR 0.5 lb per 1,000 gallons mix water.
2. Add SHORE PAC through a Venturi type mixer at 3.4-10.0 lbs per 1,000 gallons depending on desired viscosity if mixing in surface tank, if mixing directly within excavation sprinkle into stream of water slowly.
3. Take a Marsh Funnel Viscosity reading. Viscosity should be 35-125 sec/qt.

SHORE PAC dosage and the viscosity of the slurry shall be selected and controlled within ranges which suit the soil and mix water conditions of the work and according to table 3.1.

Table 3.1

FORMATION TYPE	SHORE PAC DOSAGE OR CONCENTRATION			MARSH FUNNEL VISCOSITY
	Lbs/yd^3	Lbs/1,000 gals	Kg/m^3	Sec/qt
Clay & Shale	0.7 – 0.8	3.5 - 5.0	0.5 - 0.6	35 - 50
Silt & Fine to Med. Sand	0.8 - 1.0	5.0 - 7.0	0.6 - 0.8	50 - 70
Coarse Sand to Pea Gravel	1.2 - 1.5	7.0 - 9.0	0.8 - 1.0	70 - 90
Gravel to Cobble	1.7 - 2.4	9.0 - 12.5	1.0 - 1.5	90 - 125

MAKE-UP WATER AND EFFICIENT SLURRY PRODUCTION

Sufficient water supply of proper quality for slurry make-up water shall always be available to support planned operations and unknown contingencies. Slurry mixing capability shall be immediately and continuously available to support planned operations and unexpected events. If the water supply is from a low-rate or irregular source such as a small well, a small diameter supply line, or tanker truck, a tank for storage of water shall be used to guarantee adequate and uninterrupted slurry making capacity.

SODA ASH should be used to adjust the pH and treat out calcium (Ca) and magnesium (Mg) contaminants that are detrimental to polymers. SODA ASH will adjust the pH of the mix water to between 8 and 10, which is optimum for SHORE PAC performance. The ratio of SODA ASH to water is 6 lbs per 1,000 gallons of water.

The additive DE-CHLOR is used to treat out chlorine (Cl) if municipal water is used for make-up water. Chlorine, present in municipal water, destroys all polymer molecules and decreases its viscosity if chlorine registers greater than 3 ppm. DE-CHLOR is a cost effective white granular crystal that neutralizes chlorine in municipal water and is environmentally safe. The ratio of DE-CHLOR to water is 0.5 lb per 1,000 gallons of mix water.

CONTAMINATES

Polymer slurries are sensitive to various contaminants, which occur in groundwater, soil, cement, and make-up water. Petroleum hydrocarbons, calcium, acidity, alkalinity, chlorine, and sodium chloride are some contaminants that will affect the polymer slurry. These contaminants are often introduced into the slurry from the soil, groundwater, and/or industrial wastes at the construction site. There is a need to identify and correct these problems for a smooth operation to take place. This begins with geotechnical engineers in the site investigation process. Identification and documentation should be present with soil logs and passed onto the general contractor and subcontractors. The procurement of samples of groundwater and the analysis of such samples for pH and contaminants should become a standard part of subsoil investigations conducted by geotechnical drilling service firms or by your own investigation. When contamination is present or buffering is required, additives shall be used in accordance with manufacturer's recommendations.

MIXING SHORE PAC

SHORE PAC polymer may be mixed pre-mixed in surface vessels or mixed directly within the excavation. The mix water or the prepared fluid shall be treated with appropriate additives as specified by the manufacturer.

MIXING DIRECTLY IN EXCAVATION

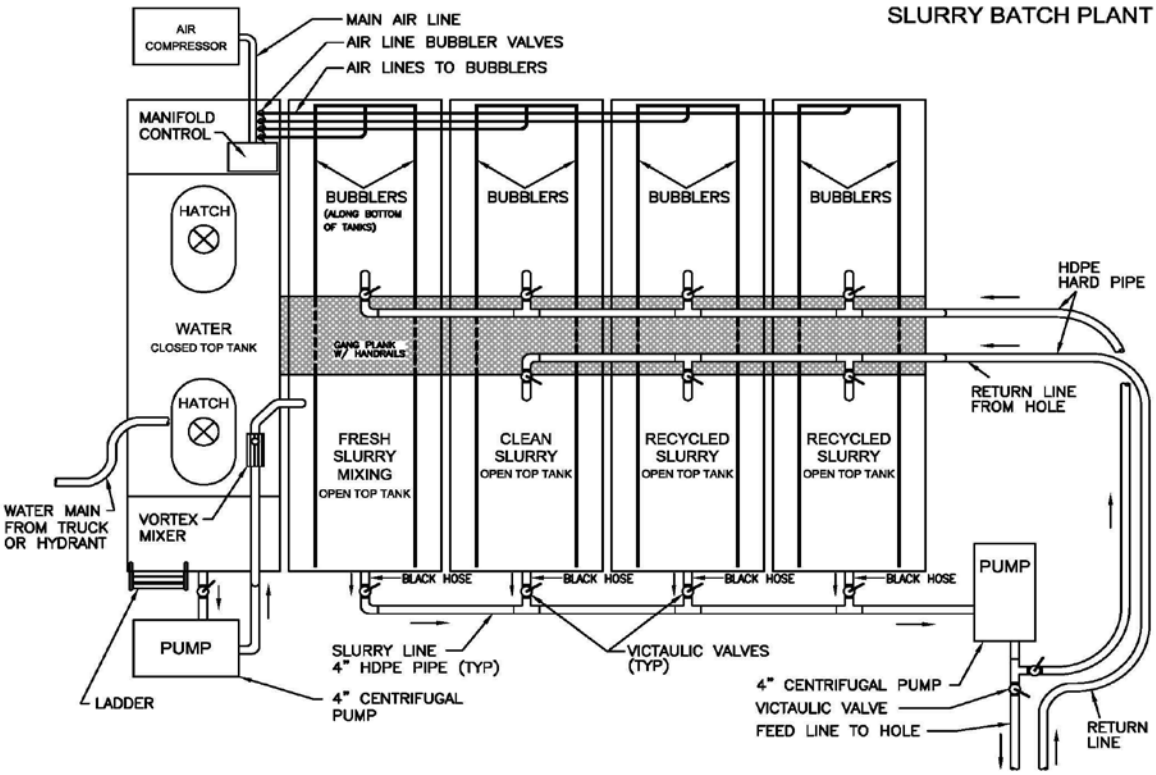
When mixing directly in the excavation it is important to have a steady stream of water that is positioned to provide a point of rapid and wide water flow for introduction of the polymer by sprinkling or sifting. Mixing of fresh polymer shall be completed by sprinkling or sifting the polymer carefully onto a flowing stream of water or fluid from a pressurized source directed into the excavation, such that the flowing fluid catches, wets, and separates the polymer grains so that they disperse and hydrate as individual particles, avoiding the forming of lumps or balls of un-mixed polymer. Dry polymer shall not be added directly onto the fluid in the excavation (as opposed to being added on a flowing stream) because this normally produces lumps or "fisheyes." The additive ACCU-VIS will create instant viscosity with out having to shear.

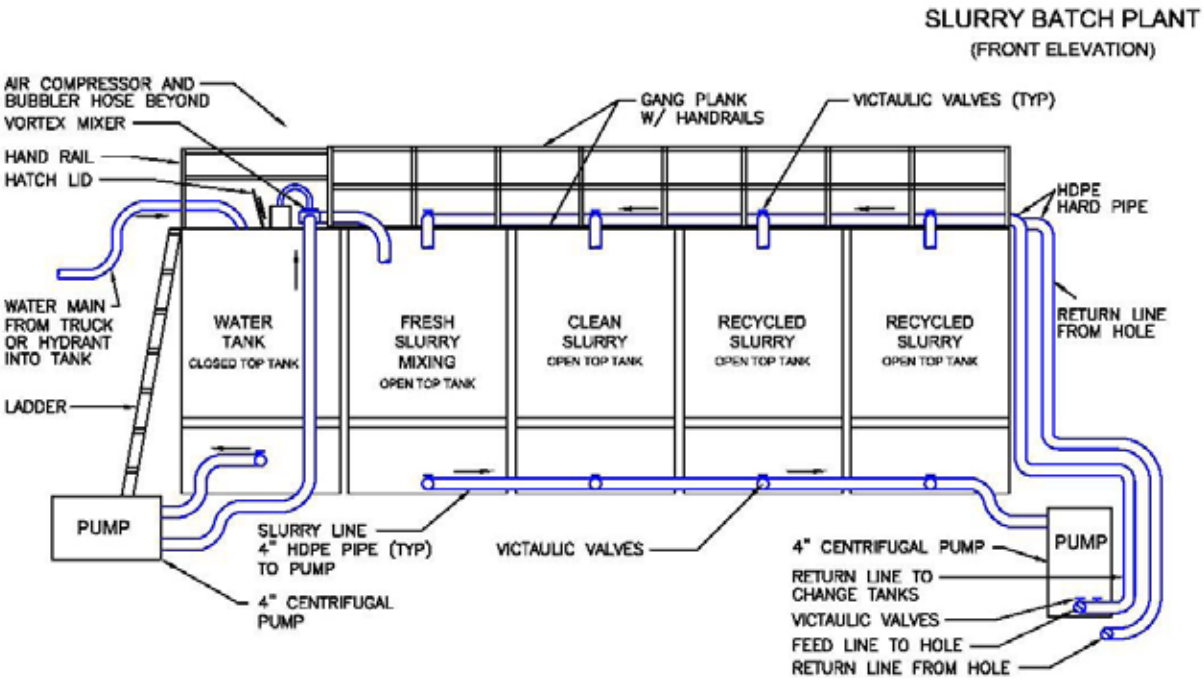
When a new polymer mix is being prepared in a hole that has been dug or drilled to significant depth before adding slurry, the excavation shall be filled with water to a water column height (measured from bottom of excavation) of no less than two meters or 15% of excavation depth, whichever is the greater, before beginning to add the polymer. SHORE PAC dry granular polymer shall be added at a controlled rate on the stream of water that is filling the hole in order to avoid lumps and fisheyes. The excavating tool (auger, bucket, clamshell) shall be reciprocated gently the full length of the slurry column while the polymer is being added, to distribute and even out the fresh polymer, and to ensure that none of the polymer settles to the bottom of the excavation during the mixing and thickening process.

When adding fresh dry polymer to recycled fluid directly in the excavation, special care must be taken to ensure good dispersion of the polymer grains to avoid forming lumps. This is because the polymer wets-out and disperses more slowly in thickened fluid than in plain water. Fanning the recycled fluid across an auger or other object to provide a point of wide and rapid flow facilitates the adding of fresh dry polymer.

MIXING IN VESSELS OR TANKS

When SHORE PAC polymer is pre-mixed in vessels it shall be added to water that is being passed through a hose, tube or hopper, across a stationary panel or surface, or stirred or otherwise agitated, in a manner which avoids the formation of lumps and results in a uniform mixture of polymer in the water. The polymer slurry shall be agitated until it develops viscosity adequate to be self-suspending (i.e., particles of partially-dissolved polymer do not settle in the fluid). This normally occurs within 15 to 30 minutes. Polymer shall not be mixed in a vessel without adequate agitation. Agitation may be accomplished by use of motorized stirrers, air injection, (as with blowpipes or fixed perforated piping), or other suitable and effective means. Recirculation by a single pump (without other means of agitation) is usually inadequate and shall not be permitted unless the mix tank is small enough that the pump provides adequate agitation of the entire tank.


SLURRY BATCH PLANT
AIR COMPRESSOR
MAIN AIR LINE
AIR LINE BUBBLER VALVES
AIR LINES TO BUBBLERS
MANIFOLD CONTROL
HATCH
BUBBLERS (ALONG BOTTOM OF TANKS)
BUBBLERS
BUBBLERS
BUBBLERS
HDPE HARD PIPE
WATER CLOSED TOP TANK
GANG PLANK W/ HANDRAILS
HATCH
RETURN LINE FROM HOLE
FRESH SLURRY MIXING OPEN TOP TANK
CLEAN SLURRY OPEN TOP TANK
RECYCLED SLURRY OPEN TOP TANK
RECYCLED SLURRY OPEN TOP TANK
WATER MAIN FROM TRUCK OR HYDRANT
VORTEX MIXER
BLACK HOSE
BLACK HOSE
BLACK HOSE
BLACK HOSE
PUMP
PUMP
SLURRY LINE 4" HDPE PIPE (TYP)
VICTAULIC VALVES (TYP)
LADDER
4" CENTRIFUGAL PUMP
4" CENTRIFUGAL PUMP
VICTAULIC VALVE
FEED LINE TO HOLE
RETURN LINE


SLURRY BATCH PLANT
(FRONT ELEVATION)
AIR COMPRESSOR AND BUBBLER HOSE BEYOND
VORTEX MIXER
HAND RAIL
HATCH LID
GANG PLANK W/ HANDRAILS
VICTAULIC VALVES (TYP)
HDPE HARD PIPE
WATER MAIN FROM TRUCK OR HYDRANT INTO TANK
WATER TANK CLOSED TOP TANK
FRESH SLURRY MIXING OPEN TOP TANK
CLEAN SLURRY OPEN TOP TANK
RECYCLED SLURRY OPEN TOP TANK
RECYCLED SLURRY OPEN TOP TANK
RETURN LINE FROM HOLE
LADDER
PUMP
SLURRY LINE 4" HDPE PIPE (TYP) TO PUMP
VICTAULIC VALVES
4" CENTRIFUGAL PUMP
PUMP
4" CENTRIFUGAL PUMP
RETURN LINE TO CHANGE TANKS
VICTAULIC VALVES
FEED LINE TO HOLE
RETURN LINE FROM HOLE

ADDITIVES

CETCO has developed a complete line of additives as companion products for SHORE PAC when problem conditions arise. Additives shall be used in accordance with recommendations listed in the table to the right. Control guidelines for use of these additives shall be pH, chlorine levels, contaminant levels, fluid behavior, and other parameters as specified by manufacturer.

This system based on the SHORE PAC polymer and specialized additives, has a track record of delivering the highest levels of performance and project economy of any slurry technology on the market including bentonite.

With this system you can stabilize the most challenging of formation conditions, cohesion-less sands, open corals, cobbles, etc., thereby eliminating collapses and controlling fluid loss. This results in reducing concrete over-breaks, saving on the quantity of concrete consumed, polymer consumed, and the time required for drilling while providing the highest levels of skin friction and rebar bonding available with a slurry system.

MAINTENANCE

The slurry level shall be maintained at least 1.8 meters (six feet) above the water table, or as such higher level that is required to overbalance hydrostatic soil pore pressure and maintain soil stability. If the slurry drops below the specified level, the operation shall be paused and the proper slurry level re-established before proceeding. In some situations the manufacturer may recommend that the slurry be maintained at less than 1.8 meters (six feet) above the water table, to reduce rates of fluid loss if soil stability is being maintained.

The point of reference for selection and maintenance of slurry level shall always be the water table (piezometric level). This applies even in situations where casing or other protective sleeve has been placed to a depth at or below the water table. The presence of casing does not remove the requirement to keep the slurry level above the water table. Attempts to excavate or hold open an excavation in saturated or unstable soils with inadequate slurry head pressure; even with casing extended into the water table, can be expected to result in soil collapse below the casing.

SAMPLING AND TESTING

Samples of the slurry shall be taken from near-bottom of the excavation, from the upper portion of the excavation, and from the slurry supply tanks (if applicable) at regular intervals during the excavating process in order to facilitate control of slurry properties.

PRODUCT	RECOMMENDED DOSAGE RATE	DESCRIPTION	FUNCTION
ACCU-VIS	Add 2-3 gals in weighted sealed plastic bag to desired area. Break open with auger and mix with drill tool	Liquid anionic polymer	Stabilizes loose granular soil, instant viscosity, no need to shear with fluid
DE-CHLOR	0.5-1.0 lbs/1,000 gals mix water	Dry chlorine neutralizer	Treats chlorine in municipal water, increases yield and performance of slurry
INSTA-CLEAR DRY	40 lbs/3,000 gals mix water	Reactive separating agent	When added into slurry acts instantly to settle suspended fines
MACRO-FILL	Add 15 lbs 1 pail directly into excavation around the circumference	Dry super-absorbent material	Controls slurry loss in extreme conditions
SAND SEALANT/ MULTI-SEAL	30 gals water or slurry, ½ bag of SAND SEALANT, and a ½ bag of MULTI-SEAL	Natural mineral solid combined with a select blend of four types of materials	Treats advanced fluid loss situations
SHORE PAC X	1-5 lbs SHORE PAC X per1,000 gallons SHORE PAC slurry	Specially synthesized polymer nano compostite	Fluid Loss Additive
SLURRY BUSTER DRY	15 lbs of SLURRY BUSTER DRY per 10,000 gallons SHORE PAC polymer slurry	Industrial grade oxidizing agent	Breaks slurry to water
SODA ASH	6 lbs/1,000 gals mix water	Dry pH adjuster	Optimizes polymer performance and yield
SODIUM BICARBONATE	5 lbs/1,000 gals mix water	A buffer used to lower pH	Treats slurry impacted by concrete
CETCO CRUMBLES/ STONE STOP	Add into hole to stop slurry loss	8-20 mesh granular sealant	Controls slurry loss in extreme conditions

SAMPLING AND TESTING (CONT'D)

During the excavation of the borehole, slurry samples shall be taken from near-bottom and upper portion at least once during the excavation, and not less than once every four hours, except for overnight shutdowns. When operating conditions make it prudent to sample and test more frequently, sampling and testing shall be done in accordance with a schedule recommended by the manufacturer or the contractor and approved by the Engineer.

Samples shall be collected with a suitable device (double ball bailer) that captures representative samples of sufficient volume (≥ 1.8 liters or 2 quarts) to perform required testing of the slurry. Samples collected as described above shall be tested for Marsh Funnel Viscosity, pH, and specific weight. A written record shall be maintained, showing viscosities, pH values, specific weights, dates, times, excavation identifiers, depths, and locations from which samples were taken (excavation, supply tank, mix tank) and other pertinent information as specified by the Engineer. Testing of specific weight and sand content may be required by the Engineer before placement of reinforcing steel and concrete, if specifications for these parameters are in force for the project.

FLUID LOSS

If high rates of fluid loss (seepage of slurry into the soil) are encountered, the polymer dosage and viscosity of the slurry shall be increased as required to provide adequate control of fluid loss consistent with allowed ranges of slurry viscosity. Alternatively or additionally, fluid loss control agents or other treatments recommended by the manufacturer may be used. Use only additives that are certified by the manufacturer to be compatible with the slurry in use.

STONE STOP is a specially blended mineral used for fluid loss control especially in sandy soils. STONE STOP added to SHORE PAC reduces slurry seepage into saturated open sands and gravels. A granular solid, STONE STOP, is highly recommended as an additive to SHORE PAC when drilling in loose saturated sands. When cobble or gravel is encountered, the viscosity may need to be increased to help prevent loss of fluid to these possible theft zones.

If losses are severe, it may be necessary to add ACCU-VIS to the slurry to either rapidly gain viscosity or use it as a "Bomb" to cut losses. ACCU-VIS can boost cohesion of sand, gravel, and cobble to stabilize and control slurry loss to a degree. ACCU-VIS sharply reduces slurry loss rates in very coarse soils and reduces bottom hole cleaning time. ACCU-VIS's thick gelatinous texture combines with fines to assist in plugging up the theft zones and helps to hold back heaving sand. The application for ACCU-VIS is 1 gallon per 1,000 gallons of fluid. It can be dropped down in weighted, thin, plastic bags, which can be torn up and mixed by the drilling tool.

ACCU-VIS may also be poured into the top of the hole, as it will mix and become viscous without having to shear by force of fluid. ACCU-VIS can be mixed and distributed through the shaft with the drilling tool without forming fisheyes.

SPECIFIC WEIGHT OF THE SLURRY

Because the primary polymers of the standard SHORE PAC system add no significant weight to slurry, measurement of slurry specific weight is a direct indicator of the soil solids content (sand, silt, clay) of the slurry. Sand content is dealt with by a sand specification. Sand tends to settle to the bottom of the excavation because the SHORE PAC polymer slurry has no tendency to gel, so temporary or transient elevated sand content is not a problem during the excavation process. Aside from sand present in the slurry, the remainder of the slurry's specific weight above the specific weight of water (1.00 kilogram per liter, 62.4 lbs/ft^3, or or 8.35 lbs/gal) comes from soil fines dispersed in the slurry. Consequently, the slurry specific weight specification is in effect a limiting factor on the amount of fines that are acceptable in the slurry. High fines content can cause problems if the fines are not held in stable suspension. The slowly-settling fines can create a bed of sediment on the bottom of the excavation after a period of time. The maximum allowable final specific weight for synthetic polymer slurries, according to the present specification, is listed in the specification table.

PREPARATION FOR CONCRETE PLACEMENT

Upon reaching final depth, an initial cleaning of the bottom of the excavation shall be effected with an appropriate tool. If indicated, the slurry column shall be allowed to stand static and undisturbed for a period of time to allow sand to settle toward the bottom of the hole. Slurry samples shall be taken intermittently during this static period from the midpoint of the excavation and from within 60 centimeters of bottom to determine sand content, viscosity, pH, and specific weight. When sand content and specific weight of near-bottom and midpoint samples are within specified maximums (see slurry quality specification tables) or when they stabilize and show no further change over a 30-minute interval during which the excavation is completely static and if tools have not been inserted (indicating sand held in stable suspension), the bottom of the excavation shall be cleaned and placement of rebar and concrete may proceed.

If the sand-size particles in the fluid are not in stable suspension but are settling very slowly, other measures may be required. For example, adjusting the fluid properties to stabilize the suspension and keep the sand from settling; agglomerating soil particles into masses (which can be extracted by the excavating tools), exchanging the fluid in the excavation with clean fluid, treating the slurry with additives to accelerate settling, or otherwise enhance removal of suspended soil.

ELAPSED TIME BETWEEN BOTTOM-CLEANING AND PLACEMENT OF CONCRETE

Not more than 120 minutes shall elapse between the final cleaning of the bottom of the excavation and the initiation of concrete placement, unless an exception is approved by the Engineer.

TESTING OF SHORE PAC POLYMER SLURRY

MARSH FUNNEL VISCOSITY (MFV)

EQUIPMENT

1. Marsh Funnel
2. Graduated one quart viscosity cup
3. Stopwatch

PROCEDURE

1. Use a double ball bailer to retrieve approximately 2 quarts of slurry.
2. Check the Marsh Funnel to verify that there is no obstruction in the outlet at the bottom of the funnel and the slurry will have an unobstructed flow. Hold funnel upright with a finger over the outlet. Pour the test sample through the screen in the top of the funnel until the mud level just reaches the under side of the screen.
3. Hold the funnel over the viscosity cup and release finger from the outlet and start timing. Record the amount of time in seconds it takes to fill up one quart.
4. Record time in sec/quart on slurry test report.

This test requires both a Marsh Funnel and a Viscosity Cup. MFV is reported in seconds per quart. The time in seconds for a quart of slurry to pass through the funnel tip is reported as viscosity in seconds per quart. MFV is very useful in determining the concentration of polymer molecules, and also its ability to stabilize surrounding soils.

pH (POTENTIAL HYDROGEN- ION)

EQUIPMENT

1. pH Indicator Paper

PROCEDURE

1. Dip a piece of pH indicator paper into the slurry and compare the color change to a standard chart. The result of this test is reported in a number from 1 to 14.
2. Record pH on slurry test report.

In this test, the range for maximum SHORE PAC performance is 8-10. This is the level at which polymer molecules can fully hydrate and extend, creating more viscosity. Levels of pH below 6 (acidic) can affect the performance of the SHORE PAC slurry and should be adjusted by adding SODA ASH, 6 lbs per 1,000 gallons mix water. In addition, the sodium carbonate ion present in 8-10 pH solutions is useful in buffering the slurry against calcium and magnesium contamination.

TESTING OF SHORE PAC POLYMER SLURRY (CONT'D)

SAND CONTENT DETERMINATION

EQUIPMENT

1. 200-mesh sieve
2. Funnel to fit into sieve
3. Glass sand content tube
4. Wash bottle

PROCEDURE

1. Fill the sand content tube with slurry to the first line marked "mud to here" then fill the remaining space in the tube to the next line marked "water to here". Place your thumb over opening and shake vigorously, inverting several times.
2. Pour the mixture on to the clean, wet screen. Discard the liquid passing through the screen. Add more water to the tube, shake, and pour onto the screen again. Repeat this until tube rinses clean. Wash the sand on the screen until discard water is clear, this removes any remaining silt and clay.
3. Fit the funnel upside down over the top of the screen. Slowly invert the assembly and insert the tip of the funnel into the glass sand content tube. Wash the sand into the tube by spraying a fine stream with the wash bottle making sure not overflow the tube (tapping the sides of the screen may facilitate this process).
4. Allow the sand to settle, from the gradations on the tube, read the volume percent of the sand and record it on the slurry test report.

This test is performed with a standard sand content kit, and the results are reported as percent sand. This test is normally performed at the completion of an excavation and just prior to placing concrete. The sample to be tested should be taken near the bottom of the excavation. When using SHORE PAC slurries the sand content will rarely test over 1.0% sand. Due to its flocculating ability, it drops the sand very quickly and the slurry remains nearly sand free. When performing the sand content test in the field the addition of SLURRY BUSTER solution in place of water to dilute the slurry sample can prevent the accumulation of silt, which creates false sand reading in the test.

SPECIFIC WEIGHT (DENSITY)

EQUIPMENT

1. Mud balance with base and cap per API spec 13B-1, Sec 1

PROCEDURE

1. Place mud balance on a flat level surface and make sure it is clean of any caked on debris.
2. Fill the cup with the slurry to be tested and place the lid on the cup, seat it firmly but slowly with a twisting motion. Be sure some mud runs out of the hole in the cap to free any trapped air.
3. With the hole in the cap covered with one finger, wash and wipe all of the slurry from the outside of the cup and arm of the balance.
4. Set the arm on the fulcrum base and move the sliding weight along the graduated arm until the cup and arm are balanced.
5. Read the density of the mud at the left edge of the sliding weight.
6. Report the results on the slurry test report to the nearest scale division in lb/gal, lb/ft^3, S.G., or psi/1,000 ft of depth.
7. Wash the mud from the cup immediately after each use. It is absolutely essential that all parts of the mud balance be kept clean for accurate results to be obtained.

This test is performed with a standard mud balance and is reported as specific gravity, pounds per cubic foot or pounds per gallon. The lbs density of SHORE PAC slurry should be approximately 64.0 lbs/ft^3. The density may be slightly higher depending on the amount of fine soil particles mixed in the slurry. SHORE PAC slurries have the same density as water, specific gravity 1.0 (± 0.05).

DRILLING CONTRACTOR: _____

SLURRY ENGINEER: _____

CONTRACT #: _____

DATE: _____

PROJECT INSPECTOR: _____

SHAFT #: _____

DIAMETER: _____

T.D. DEPTH: _____

HOLE VOLUME: _____

PRODUCTS ADDED: _____

TESTS PERFORMED	SAMPLE #1	SAMPLE #2	SAMPLE #3	SAMPLE #4
Time				
Depth (Feet)				
pH (1-14)				
Marsh Funnel Viscosity (Sec/qt)				
Density (lb/gal)				
Sand Content (%)				
Soil Conditions				

COMMENTS: _____

CETCO REPRESENTATIVE/SLURRY ENGINEER: _____

QUALITY SPECIFICATIONS FOR SLURRIES BASED ON SHORE PAC

SHORE PAC POLYMER SLURRY		
Property	Requirement	Test
Density (lb/ft^3) - just prior to placing concrete	less than or equal to 64*	Mud Weight (Density) API 13 B-1Section 1
Viscosity (seconds/quart)	35 to 135	Marsh Funnel and Cup API 13 B-1 Section 2.2
pH	8.0 to 10.0	Glass Electrode pH Meter or pH Paper
Sand Content (%) - just prior to placing concrete	less than or equal to 1.0%	Sand API 13 B-1 Section 5
*When approved by the engineer, slurry may be used in saltwater, and the allowable densities may be increased up to 2 pcf. Slurry temperature shall be at least 4°C (40°F) when tested.		

SHORE PAC is not a hazardous waste, nor does it pose any threat to waters when disposed of according to manufacturer's guidelines.

SHORE PAC is approved for use by The Federal Highway Administration, (FHWA) and is used in State Departments of Transportation throughout the nation. The method for disposing the drilling slurry SHORE PAC on Drilled Shaft Projects has been listed within this correspondence.

DEFINITION AND INGREDIENTS OF SHORE PAC

SHORE PAC is a dry granular synthetic anionic polyacrylamide. SHORE PAC is manufactured from co-polymerization of acrylimide and acrylic acid or its inorganic salts. The molecular weight (in the region of several million Daltons) and negative charge density varies (by variation of the ratio of acrylimide and acrylic acid monomer units).

The polymer used in the product SHORE PAC is designated as non hazardous and is water soluble or water dispersible. The term polymer simply means – many parts, or is an organic chemical having a molecular weight above 200, with greater than eight repeating units. Polymers vary greatly in function and basic properties, such as stability, charge, and molecular weight. In general, polymers can be classified as natural, modified-natural, or synthetic. The term "monomer" simply means – a large molecule made up of simple repeating units.

A polymer is a compound that consists of a chain of repeating base units, called monomers. SHORE PAC is a synthetic polymer.

DEFINITION AND INGREDIENTS OF SHORE PAC

SHORE PAC is a very high molecular weight synthetic polymer with negative charges on the backbone. Its high molecular weight gives viscosity to water at low concentrations.

When SHORE PAC is dissolved in aqueous solution, the very long polymer chains dissolve and orient randomly in the fluid in coils. In freshwater, the repulsion of the negative charges on the backbone of the polymer chains causes the coils to expand and to occupy a large volume in the fluid. When the fluid is sheared, the expanded polymer chains are located in different fluid layers in the shear field. The uncoiling of these expanded polymer chains dissipates mechanical energy and results in viscosity.

The high molecular weight polymer chains are so long that different parts of individual polymer chains bridge different solid particles. It is this adsorption on surfaces and bridging of solid surfaces that makes this polymer effective in keeping solids consolidated while drilling a foundation. In addition, the adsorbed layer of hydrophilic polymer on rock surfaces slows down the diffusion of water into the rock.

CONTROL PRESSURE AND STABILIZE THE BOREHOLE

Two types of pressure are exerted on the borehole during drilling, formation pressure and hydrostatic pressure. Formation pressure can collapse the borehole if it is not overcome by hydrostatic pressure pushing back against the formation. Hydrostatic pressure is the weight or density of the volume of drilling slurry pushing against the formation. In order to have hydrostatic pressure, the drilling slurry must push back against the formation with minimal penetration into the formation. In unconsolidated permeable formations, the hydrostatic pressure occurs when the weight of the fluid is in contact with the impermeable deposits (filter cake) placed on the sides of the borehole by the drilling slurry. The filter cake and the hydrostatic pressure thereby control the formation pressure, reduce slurry loss and prevent caving, resulting in hole stabilization.

QUALITY SPECIFICATIONS FOR SLURRIES BASED ON SHORE PAC

Normal water weighs 8.34 lb/gal, with the SHORE PAC polymer fluid at 8.40 lb/gal it is necessary to maintain the slurry level 2 to 3 meters (7 to 10 feet) above the surrounding groundwater level. Under normal conditions this 2 to 3 meters of hydrostatic pressure, or head, exerts the pressure necessary (approx. 450 to 640 lb/ft^2, or 2,000 to 3,000 kg/m^2), to support the walls of the excavation and is required to ensure hole stability. Without this positive pressure exerted by the slurry column against the sidewall, soil overburden pressures will cause the excavation to collapse. The natural soil overburden pressures forced against the positive pressure exerted by the slurry column result in little or no leach ability to the surrounding formation.

RECYCLING OF THE SHORE PAC SLURRY

After the slurry testing has been completed and the rebar has been placed, a suction line should be dropped just inside the excavation for recycling of the slurry. While the concrete is being tremied it will displace the slurry forcing it upward. A holding tank large enough to hold the volume of slurry contained within the excavation is required to recycle the SHORE PAC slurry. When concrete is tremie pumped into the bottom of the hole, the displaced SHORE PAC slurry is pumped from the top of the excavation into the holding tank using a centrifugal pump. Disregard concerns about shearing the polymer and destroying it, this is the only pump that will pump a large enough volume to keep-up with the concreted pump truck.

Avoid pumping the last three feet of slurry above the concrete interface, as this slurry will be contaminated from contact with the concrete. The impacted slurry looks like oatmeal and only occurs at the contact with the concrete. The last three feet of impacted slurry should be pumped off to a waste tank, or if allowed the cement contaminated slurry can be released over the top can onto the ground to be mixed into the spoil pile by the loader.

The recycled SHORE PAC slurry is tested for viscosity and pH. While adding water to restore the original volume additional SODA ASH is added to adjust the pH. Next the SHORE PAC is added to restore the slurry to full strength. Usually it requires about ¼ of the amount of SHORE PAC added to the water filling up the holding tank to restore the slurry to its original strength for reuse on the next hole.

BREAKDOWN OF SLURRY

SHORE PAC slurry fluids are non-toxic and are readily degradable upon completion of a project to facilitate disposal. Upon completion of the project, any remaining SHORE PAC is broken down with the chemical oxidizers. SLURRY BUSTER DRY is the most common oxidizer for this purpose. SLURRY BUSTER DRY is calcium hypochlorite.

SLURRY BUSTER DRY is added to the SHORE PAC slurry at a rate of 15 lbs per 10,000 gallons of SHORE PAC slurry. This is accomplished by pumping it back into a holding tank or holding pond and circulating it using the pumps on-site to ensure complete oxidation of the polymer molecules.

SLURRY BUSTER DRY concentrations of 15 lbs per 10,000 gallons of SHORE PAC destroys the active ingredients within the sodium hypochlorite (bleach) and at the same time breaks the polymer, reverting it back to basic water. The end result of SHORE PAC decomposing after its encounter with SLURRY BUSTER DRY is the acrylic acid backbone which is an inert nontoxic substance.

DISPOSAL OF DRILLING SLURRY

Treated slurry fluids are environmentally safe when handled as directed. When breakdown is complete, all that remains is trace acrylate molecules, water and and perhaps some small amount of excess chlorine. The anionic SHORE PAC is reduced to water after the hypochlorite is used to treat the SHORE PAC. This is often safely discharged, or spread on the ground to evaporate, or used in dust control.

Additionally, polymers with the same chemical base as found in SHORE PAC are used in potable water treatment as flocculants, with federal government clearance. They are widely used throughout the world as coagulants and flocculants used for environmental and process improvement, acting through solid/liquid separation. They are used in paper manufacturing, wastewater treatment, mineral and oil extraction, soil conditioning, and as thickeners in cosmetics. As such, they have many regulatory approvals around the world, such as for drinking water treatment, indirect additives for food-contact paper, and for other specific uses. Municipal sewage sludge, which has been polymer-treated for de-watering, is widely applied to agricultural land.

MICHELS®
FOUNDATIONS

TAB 5

FLATIRON|LANE Request for Approval of Material

KLF Use Only

Contract:	Subcontractor:	For (Location)	
9242	N/A	Project Wide Use	
	Date: 01/18/2021	Transmittal Package No. FLJV-WTRN-9242-00441	**RAM NUMBER:** 0171

ROM #	Material or Manufacturer's Product/Type	Name and Location of Fabricator, Manufacturer or Pit Number	Unit Of Measure	WSDOT Specs Reference	RAM Approval Action Code	QPL	Requirements
6-02.3(2)A - STP11	Mix Design #CL4KP Class 5000P	Stoneway Concrete Batch Plant #11 Seattle, WA	CY	6-02.3 (2)A	1	Listed on QPL Yes ☐ No ☑ QPL Code:	MCC ☐ Mill Cert ☐ Test Rpt. ☑ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐
6-02.3(2) A- STP12	Mix Design #CL4KP Class 5000P	Stoneway Concrete Batch Plant #12 Renton, WA	CY	6-02.3 (2)A	1	Listed on QPL Yes ☐ No ☑ QPL Code:	MCC ☐ Mill Cert ☐ Test Rpt. ☑ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐
6-02.3(2)A - STP14	Mix Design #CL4KP Class 5000P	Stoneway Concrete Batch Plant #14 Renton, WA	CY	6-02.3 (2)A	1	Listed on QPL Yes ☐ No ☑ QPL Code:	MCC ☐ Mill Cert ☐ Test Rpt. ☑ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐
9-01.2(1)B - ACC	Cement Type IL (X)	Ashgrove Cement Co Seattle, WA	LBS	9-01.2 (1)B	2*	Listed on QPL Yes ☑ No ☐ QPL Code: 2525	MCC ☐ Mill Cert ☑ Test Rpt. ☐ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐
9-01.2(1)B - LNA	Cement Type IL (15)	Lafarge NA Richmond, BC	LBS	9-01.2 (1)B	2	Listed on QPL Yes ☑ No ☐ QPL Code: 2525	MCC ☐ Mill Cert ☑ Test Rpt. ☐ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐

Material Approval Engineer	Date 02/17/2021
Construction Quality Assurance Manager	Date 02/17/2021

Approval Action Codes for use by QA/QC & State Materials Laboratory

1. Acceptance Criteria: Acceptance based upon 'Satisfactory' Test Report for samples of materials to be incorporated into project.
2. Acceptance Criteria: Mfg. Cert. of Compliance for 'Acceptance' prior to use of material.
3. Acceptance Criteria: Catalog Cuts for 'Acceptance' prior to use of material.
4. Acceptance Criteria: Submit Shop Drawings for 'Approval' prior to fabrication of material.
5. Acceptance Criteria: Only 'Approved for Shipment', 'WSDOT Inspected' or 'Fabrication Approved Decal' material shall be used.
6. Acceptance Criteria: Submit Certificate of Materials Origin.
7 Acceptance Criteria: Request Transmitted to State Materials Laboratory for Approval Action.
8. Source Approved: Visually Verify Material is As Approved.
9. Approval Withheld: Submit samples for preliminary evaluation.
10. Approval Withheld:
11. Miscellaneous Acceptance Criteria:

Remarks:

*See attached Stoneway letter dated February 11, 2021 regarding Mill Cert designation for Ashgrove Cement.

FLATIRON|LANE Request for Approval of Material

KLF Use Only

Contract:	Subcontractor:	For (Location)	
9242	N/A	Project Wide Use	
	Date: 01/18/2021	Transmittal Package No. FLJV-WTRN-9242-00441	**RAM NUMBER:** 0171

ROM #	Material or Manufacturer's Product/Type	Name and Location of Fabricator, Manufacturer or Pit Number	Unit Of Measure	WSDOT Specs Reference	RAM Approval Action Code	QPL	Requirements
9-23.10-LNA	NewCem Slag Grade 100	Lafarge NA Seattle, WA	LBS	9-23.10	2	Listed on QPL Yes ☑ No ☐ QPL Code: 2530	MCC ☐ Mill Cert ☑ Test Rpt. ☐ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐
9-03.1(4)-CAP	Coarse Concrete Aggregate	Glacier Northwest, Dupont, Wa Pit # B-335	LBS	9-03.1 (4)	1	Listed on QPL Yes ☐ No ☑ QPL Code:	MCC ☐ Mill Cert ☐ Test Rpt. ☑ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐
9-03.1(2)-CAP	Fine Concrete Aggregate	Glacier Northwest Dupont, WA Pit# B-335	LBS	9-03.1 (2)	1	Listed on QPL Yes ☐ No ☑ QPL Code:	MCC ☐ Mill Cert ☐ Test Rpt. ☑ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐
9-03.1(4)-QRP	Coarse Concrete Aggregate	Quality Rock Products Lake Francis, WA Pit #A458	LBS	9-03.1 (4)	1	Listed on QPL Yes ☐ No ☑ QPL Code:	MCC ☐ Mill Cert ☐ Test Rpt. ☑ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐
9-03.1(2)-QRP	Fine Concrete Aggregate	Quality Rock Products Lake Francis, WA Pit #A458	LBS	9-03.1 (2)	1	Listed on QPL Yes ☐ No ☑ QPL Code:	MCC ☐ Mill Cert ☐ Test Rpt. ☑ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐

Material Approval Engineer	Date 02/17/2021
Construction Quality Assurance Manager	Date 02/17/2021

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9. Approval Withheld: Submit samples for preliminary evaluation.
10. Approval Withheld:
11. Miscellaneous Acceptance Criteria:

Remarks:

FLATIRON|LANE Request for Approval of Material

KLF Use Only

Contract:	Subcontractor:	For (Location)	
9242	N/A	Project Wide Use	
	Date: 01/18/2021	Transmittal Package No. FLJV-WTRN-9242-00441	**RAM NUMBER:** 0171

ROM #	Material or Manufacturer's Product/Type	Name and Location of Fabricator, Manufacturer or Pit Number	Unit Of Measure	WSDOT Specs Reference	RAM Approval Action Code	QPL	Requirements
9-23.6(5)-GCP	Hydration Stabilizer Type D Recover	GCP Applied Technologies / formerly W.R. Grace and Company Vancouver, BC	OZ	9-23.6 (5)	2	Listed on QPL Yes ☑ No ☐ QPL Code: 2250	MCC ☑ Mill Cert ☐ Test Rpt. ☐ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐
9-23.6(2)-GCP	Water Reducer Zyla 630 Type A	GCP Applied Technologies / formerly W.R. Grace and Company Vancouver, BC	OZ	9-23.6 (2)	2	Listed on QPL Yes ☑ No ☐ QPL Code: 2250	MCC ☑ Mill Cert ☐ Test Rpt. ☐ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐
						Listed on QPL Yes ☐ No ☐ QPL Code:	MCC ☐ Mill Cert ☐ Test Rpt. ☐ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐
						Listed on QPL Yes ☐ No ☐ QPL Code:	MCC ☐ Mill Cert ☐ Test Rpt. ☐ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐
						Listed on QPL Yes ☐ No ☐ QPL Code:	MCC ☐ Mill Cert ☐ Test Rpt. ☐ Cat. Cuts ☐ Shop Drw. ☐ Stamp/Tag ☐

Material Approval Engineer	Date 02/17/2021
Construction Quality Assurance Manager	Date 02/17/2021

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9. Approval Withheld: Submit samples for preliminary evaluation.
10. Approval Withheld:
11. Miscellaneous Acceptance Criteria:

Remarks:

Washington State Department of Transportation

Concrete Mix Design

Contractor	Submitted By	Date
Project Wide All Contractors	Adam Gaunt - Stoneway Concrete	01/18/2021

Concrete Supplier	Plant Location
Stoneway Concrete	East Marginal Way, Seattle

Contract Number	Contract Name
9242	I405 Renton To Bellevue

This mix is to be used in the following Bid Item No(s): _____

Concrete Class: Other - Define in Remarks

Remarks

Class 5000P

Recycled water to be used at 50% unless specified at time of order, extra charges may apply

Mix Design No. CL4KP **Plant No.** 11

Cementitious Materials	Source	Plant	Type, Class or Grade	Sp. Gr.	Lbs/cy
Cement	Ashgrove	Seattle, WA	ASTM C 595 Type IL (X)	3.1	600
Fly Ash [a]			☐ F ☐ C Alkali % _____		
GGBFS (Slag) [a]	Lafarge NA	Seattle, WA	☑ 100 ☐ 120	2.87	181

Concrete Admixtures	Manufacturer	Product	Est. Range (oz/cy)
Air Entrainment			
Water-Reducing Type A	GCP Applied Technologies	Zyla 630	1-50
Water-Reducing and Retarding Type D	GCP Applied Technologies	Recover	1-50

Water (Maximum) 312 lbs/cy

Is any of the water Recycled or Reclaimed? ☑ Yes[d] ☐ No

Water Cementitious Ratio (Maximum) 0.40

Mix Design Density (pcf) 147.8

Design Performance (Attach Test Data)

Average 28-day compressive strength (psi) 8020

Average 14-day flexural strength (psi) (Concrete Pavement Only)

Concrete Chloride Ion Content (% by mass of cement) .0094 ☐ Water Soluble ☑ Acid Soluble

Agency Use Only (Check appropriate Box)

☒ **This Mix Design MEETS CONTRACT SPECIFICATIONS and may be used on the bid items noted above**

☐ **This Mix Design DOES NOT MEET CONTRACT SPECIFICATIONS and is being returned for corrections**

Reviewed By: _____ 2/17/2021

PE Signature Date

DOT Form 350-040 Revised 01/2020

Distribution: Original - Contractor
Copies To - State Materials Lab - Structural Materials Eng. ; Regional Materials Lab; Project Inspector

Mix Design No. CL4KP **Plant No.** 11

Aggregate Gradation ☑ AASHTO ☐ Combined **Nominal Maximum Size (In)** 3/8

Aggregates	1	2	3	4	5	Total
WSDOT Source No. [b]	B335	B335				
Source Expiration Date [b]	03/09/25	03/09/25				
ASR Expansion (%) b ☐ 14 Day ☑ 1 Year	.03	.03				
Is ASR Mitigation Required?	NO	NO				
Stock Pile Grading [c]	#8	Class 1				
Percent of Total Aggregate	55	45				100
Specific Gravity (SSD)	2.69	2.66				
Lbs/cy (ssd)	1611	1320				2931
Include Percent Passing for each aggregate component. Include Total only for Combined Gradations.	**Percent Passing**					**Total**
2 inch	100.00	100.00				100.00
1-1/2 inch	100.00	100.00				100.00
1 inch	100.00	100.00				100.00
3/4 inch	100.00	100.00				100.00
1/2 inch	100.00	100.00				100.00
3/8 inch	92.00	100.00				95.60
No. 4	25.00	100.00				58.78
No. 8	2.00	85.00				39.38
No. 16	1.00	63.00				28.92
No. 30	0.00	38.00				17.11
No. 50	0.00	15.00				6.76
No. 100	0.00	5.00				2.25
No. 200	0.00	2.00				0.90

Fineness Modulus: (Required for Class 2 Sand)

Proposed ASR Mitigation Method:

Notes:

a Fly ash or GGBFS is required for Class 4000P mix.

b Enter data from WSDOT ASA Database. ASR Mitigation is required for sources with 14-day expansions greater than 0.20%. No mitigation is required if the 1-year expansion is less than 0.04%. Proposed mitigation methods for 14-day expansions greater than 0.45% require ASTM C 1567 tests proving that the method is effective. See WSDOT Standard Specification 9-03.1.

c Stockpile gradation: AASHTO No. 467, 57, 67, 7, 8; WSDOT Class 1, Class 2; or combined gradation stockpile sizes. See WSDOT Standard Specification 9-03.1.

d Attach test results indicating conformance to Standard Specification 9-25.1.

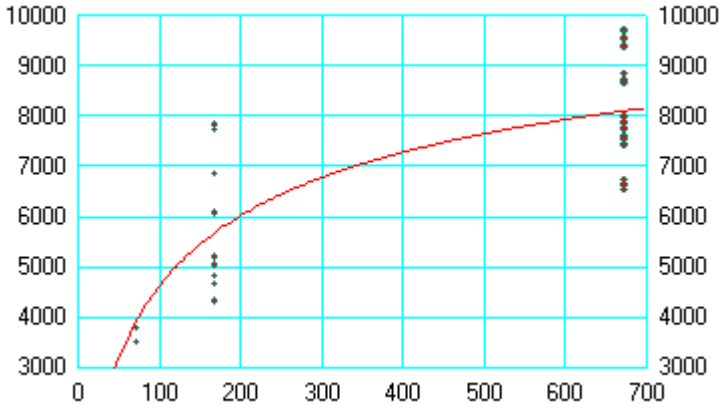
Date: 1/18/2021

Stoneway Concrete
Where Quality Counts
9216 8th AVENUE S
SEATTLE, WA 98108
OFFICE:(425)226-1000
FAX:(425)228-4924

Mix Name: CL4KP

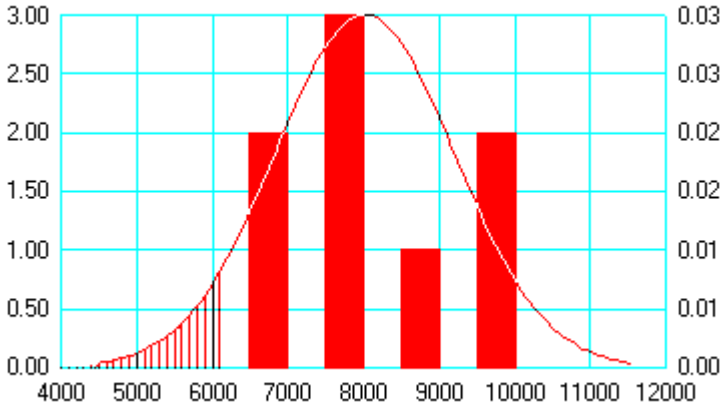
Units : US

PSI **Strength and Strength Fit vs Maturity**



Maturity Hours

PSI # of Occ. **Histogram for 28 Day Strength** **%/PSI**



PSI

95% of tests lie above cross-hatched area

STRENGTH SUMMARY, Compression Either 4" x 8" Or 6" x 12"

No. Of Tests	Avg Slump	Avg Air	Avg 3 Day Strengths	Avg 7 Day	Avg 28 Day	Avg 56 Day	Avg Acc Age	Accept Age
8	8.00	1.30	3650	5540	8020		8020	28

Std Dev	ACI318 Req'd
	6200

DETAILED STRENGTH, Compression Either 4" x 8" Or 6" x 12"

Mix Number	Test Number	Date	Plant	Slump	Spread	Air	Strengths 3 Day	7 Day	28 Day	56 Day	A
CL4KP	924149	11/5/2019	11 Seat	8.25		1.30	3650	4860	7630		
CL4KP	SF361	1/5/2020	11 Seat	7.50				7790	9640		
CL4KP	RC404574	1/8/2020	11 Seat	8.00				5210	7770		
CL4KP	RC404576	1/10/2020	11 Seat	8.25				4830	7530		
CL4KP	RC390188	1/13/2020	11 Seat	8.00				6850	9600		
CL4KP	rc390239	1/16/2020	11 Seat	8.00				6080	8730		
CL4KP	1562055	1/22/2020	11 Seat	8.00				4340	6630		
CL4KP	RC396685	1/22/2020	11 Seat	8.00				4340	6630		

Washington State Department of Transportation

Concrete Mix Design

Contractor	Submitted By	Date
Project Wide All Contractors	Adam Gaunt - Stoneway Concrete	01/18/2021

Concrete Supplier	Plant Location
Stoneway Concrete	Black River, Renton

Contract Number	Contract Name
9242	I405 Renton To Bellevue

This mix is to be used in the following Bid Item No(s): _____

Concrete Class: Other - Define in Remarks

Remarks

Class 5000P

Recycled water to be used at 50% unless specified at time of order, extra charges may apply

Mix Design No. CL4KP **Plant No.** 12

Cementitious Materials	Source	Plant	Type, Class or Grade	Sp. Gr.	Lbs/cy
Cement	Lafarge NA	Richmond, BC	ASTM C 595 Type IL(15)	3.15	600
Fly Ash [a]			☐ F ☐ C Alkali % _____		
GGBFS (Slag) [a]	Lafarge NA	Seattle, WA	☑ 100 ☐ 120	2.87	181

Concrete Admixtures	Manufacturer	Product	Est. Range (oz/cy)
Air Entrainment			
Water-Reducing Type A	GCP Applied Technologies	Zyla 630	1-50
Water-Reducing and Retarding Type D	GCP Applied Technologies	Recover	1-50

Water (Maximum) 312 lbs/cy

Is any of the water Recycled or Reclaimed? ☑ Yes[d] ☐ No

Water Cementitious Ratio (Maximum) 0.40

Mix Design Density (pcf) 147.1

Design Performance (Attach Test Data)

Average 28-day compressive strength (psi) 7820

Average 14-day flexural strength (psi) (Concrete Pavement Only)

Concrete Chloride Ion Content (% by mass of cement) .0094 ☐ Water Soluble ☑ Acid Soluble

Agency Use Only (Check appropriate Box)

☒ **This Mix Design MEETS CONTRACT SPECIFICATIONS and may be used on the bid items noted above**

☐ **This Mix Design DOES NOT MEET CONTRACT SPECIFICATIONS and is being returned for corrections**

Reviewed By: _____ 2/17/21

PE Signature Date

DOT Form 350-040 Revised 01/2020

Distribution: Original - Contractor
Copies To - State Materials Lab - Structural Materials Eng. ; Regional Materials Lab; Project Inspector

Mix Design No. CL4KP **Plant No.** 12

Aggregate Gradation ☑ AASHTO ☐ Combined **Nominal Maximum Size (In)** 3/8

Aggregates	1	2	3	4	5	Total
WSDOT Source No. [b]	A458	A458				
Source Expiration Date [b]	08/25/21	08/25/21				
ASR Expansion (%) b ☐ 14 Day ☑ 1 Year	.03	.03				
Is ASR Mitigation Required?	NO	NO				
Stock Pile Grading [c]	#8	Class 1				
Percent of Total Aggregate	53	47				100
Specific Gravity (SSD)	2.69	2.60				
Lbs/cy (ssd)	1551	1357				2908
Include Percent Passing for each aggregate component. Include Total only for Combined Gradations.	**Percent Passing**					**Total**
2 inch	100.00	100.00				100.00
1-1/2 inch	100.00	100.00				100.00
1 inch	100.00	100.00				100.00
3/4 inch	100.00	100.00				100.00
1/2 inch	100.00	100.00				100.00
3/8 inch	96.00	100.00				97.87
No. 4	16.00	100.00				55.20
No. 8	2.00	80.00				38.40
No. 16	1.00	59.00				28.07
No. 30	0.00	32.00				14.93
No. 50	0.00	10.00				4.67
No. 100	0.00	2.00				0.93
No. 200	0.00	1.00				0.47

Fineness Modulus: (Required for Class 2 Sand)

Proposed ASR Mitigation Method:

Notes:

a Fly ash or GGBFS is required for Class 4000P mix.

b Enter data from WSDOT ASA Database. ASR Mitigation is required for sources with 14-day expansions greater than 0.20%. No mitigation is required if the 1-year expansion is less than 0.04%. Proposed mitigation methods for 14-day expansions greater than 0.45% require ASTM C 1567 tests proving that the method is effective. See WSDOT Standard Specification 9-03.1.

c Stockpile gradation: AASHTO No. 467, 57, 67, 7, 8; WSDOT Class 1, Class 2; or combined gradation stockpile sizes. See WSDOT Standard Specification 9-03.1.

d Attach test results indicating conformance to Standard Specification 9-25.1.

Washington State Department of Transportation

Concrete Mix Design

Contractor	Submitted By	Date
Project Wide All Contractors	Adam Gaunt - Stoneway Concrete	01/18/2021

Concrete Supplier	Plant Location
Stoneway Concrete	Houser Way, Renton

Contract Number	Contract Name
9242	I405 Renton To Bellevue

This mix is to be used in the following Bid Item No(s): _____

Concrete Class: Other - Define in Remarks

Remarks

Class 5000P

Recycled water to be used at 50% unless specified at time of order, extra charges may apply

Mix Design No. CL4KP **Plant No.** 14

Cementitious Materials	Source	Plant	Type, Class or Grade	Sp. Gr.	Lbs/cy
Cement	Lafarge NA	Richmond, BC	ASTM C 595 Type IL(15)	3.15	600
Fly Ash [a]			☐ F ☐ C **Alkali %** _____		
GGBFS (Slag) [a]	Lafarge NA	Seattle, WA	☑ **100** ☐ **120**	2.87	181

Concrete Admixtures	Manufacturer	Product	Est. Range (oz/cy)
Air Entrainment			
Water-Reducing Type A	GCP Applied Technologies	Zyla 630	1-50
Water-Reducing and Retarding Type D	GCP Applied Technologies	Recover	1-50

Water (Maximum) 312 lbs/cy

Is any of the water Recycled or Reclaimed? ☑ Yes[d] ☐ No

Water Cementitious Ratio (Maximum) 0.40

Mix Design Density (pcf) 147.1

Design Performance (Attach Test Data)

Average 28-day compressive strength (psi) 7820

Average 14-day flexural strength (psi) (Concrete Pavement Only)

Concrete Chloride Ion Content (% by mass of cement) .0094 ☐ Water Soluble ☑ Acid Soluble

Agency Use Only (Check appropriate Box)

☒ **This Mix Design MEETS CONTRACT SPECIFICATIONS and may be used on the bid items noted above**

☐ **This Mix Design DOES NOT MEET CONTRACT SPECIFICATIONS and is being returned for corrections**

Reviewed By: _____ 2/17/21

PE Signature Date

DOT Form 350-040 Revised 01/2020

Distribution: Original - Contractor
Copies To - State Materials Lab - Structural Materials Eng. ; Regional Materials Lab; Project Inspector

Mix Design No. CL4KP **Plant No.** 14

Aggregate Gradation ☑ AASHTO ☐ Combined **Nominal Maximum Size (In)** 3/8

Aggregates	1	2	3	4	5	Total
WSDOT Source No. [b]	A458	A458				
Source Expiration Date [b]	08/25/21	08/25/21				
ASR Expansion (%) b ☐ 14 Day ☑ 1 Year	.03	.03				
Is ASR Mitigation Required?	NO	NO				
Stock Pile Grading [c]	#8	Class 1				
Percent of Total Aggregate	53	47				100
Specific Gravity (SSD)	2.69	2.60				
Lbs/cy (ssd)	1551	1357				2908
Include Percent Passing for each aggregate component. Include Total only for Combined Gradations.	**Percent Passing**					**Total**
2 inch	100.00	100.00				100.00
1-1/2 inch	100.00	100.00				100.00
1 inch	100.00	100.00				100.00
3/4 inch	100.00	100.00				100.00
1/2 inch	100.00	100.00				100.00
3/8 inch	96.00	100.00				97.87
No. 4	16.00	100.00				55.20
No. 8	2.00	80.00				38.40
No. 16	1.00	59.00				28.07
No. 30	0.00	32.00				14.93
No. 50	0.00	10.00				4.67
No. 100	0.00	2.00				0.93
No. 200	0.00	1.00				0.47

Fineness Modulus: (Required for Class 2 Sand)

Proposed ASR Mitigation Method:

Notes:

a Fly ash or GGBFS is required for Class 4000P mix.

b Enter data from WSDOT ASA Database. ASR Mitigation is required for sources with 14-day expansions greater than 0.20%. No mitigation is required if the 1-year expansion is less than 0.04%. Proposed mitigation methods for 14-day expansions greater than 0.45% require ASTM C 1567 tests proving that the method is effective. See WSDOT Standard Specification 9-03.1.

c Stockpile gradation: AASHTO No. 467, 57, 67, 7, 8; WSDOT Class 1, Class 2; or combined gradation stockpile sizes. See WSDOT Standard Specification 9-03.1.

d Attach test results indicating conformance to Standard Specification 9-25.1.

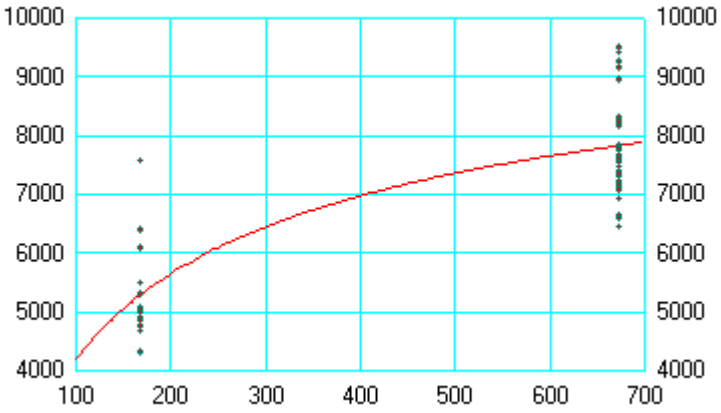
Date: 1/18/2021

Stoneway Concrete
Where Quality Counts
9216 8th AVENUE S
SEATTLE, WA 98108
OFFICE:(425)226-1000
FAX:(425)228-4924

Mix Name: CL4KP

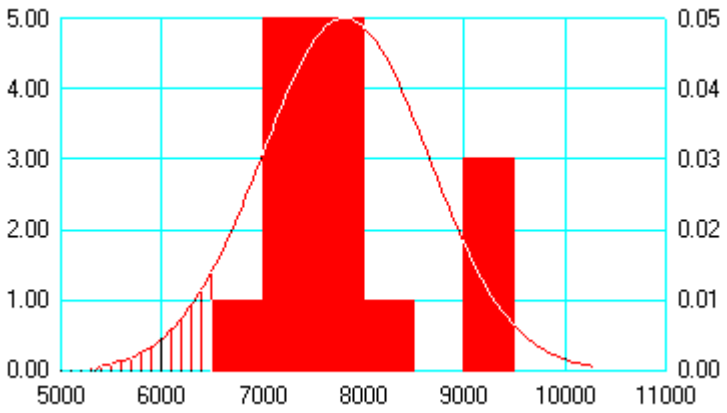
Units : US

PSI **Strength and Strength Fit vs Maturity**



Maturity Hours

PSI # of Occ. **Histogram for 28 Day Strength** **%/PSI**



PSI

95% of tests lie above cross-hatched area

STRENGTH SUMMARY, Compression Either 4" x 8" Or 6" x 12"

No. Of Tests	Avg Slump	Avg Air	Avg 3 Day Strengths	Avg 7 Day	Avg 28 Day	Avg 56 Day	Avg Acc Age	Accept Age
15	7.38	.00		5260	7820		7820	28

Std Dev	ACI318 Req'd
590	6090

DETAILED STRENGTH, Compression Either 4" x 8" Or 6" x 12"

Mix Number	Test Number	Date	Plant	Slump	Spread	Air	Strengths 3 Day	7 Day	28 Day	56 Day	A
CL4KP	999773	7/16/2019	14 Hous	5.00			6100	8240			
CL4KP	E238622	9/10/2019	14 Hous				7580	9200			
CL4KP	E238621	9/10/2019	14 Hous	8.00			5500	9390			
CL4KP	RC389815	1/6/2020	14 Hous	6.00			6400	9190			
CL4KP	RC404575	1/9/2020	14 Hous	7.50			5000	7730			
CL4KP	RC390242	1/14/2020	14 Hous	7.50			4870	7450			
CL4KP	RC390195	1/15/2020	14 Hous	8.00			4770	7200			
CL4KP	RC390241	1/17/2020	14 Hous	7.50			4690	7530			
CL4KP	RC396683	1/20/2020	14 Hous	7.50			5310	7730			
CL4KP	RC396684	1/21/2020	14 Hous	7.00			4920	7370			
CL4KP	RC396687	1/23/2020	14 Hous	7.50			4980	7480			
CL4KP	RC396689	1/24/2020	14 Hous	8.00			4330	7050			
CL4KP	RC396691	1/27/2020	14 Hous	7.50			5090	7510			
CL4KP	RC396693	1/28/2020	14 Hous	8.25			5060	7650			
CL4KP	RC396695	1/29/2020	14 Hous	8.00			4350	6570			

National Ready Mixed Concrete Association

Certificate of Conformance For Concrete Production Facilities

THIS IS TO CERTIFY THAT

Seattle Plant, Seattle, WA

Stoneway Concrete

has been inspected by the undersigned licensed professional engineer for conformance with the requirements of the *Check List for Ready Mixed Concrete Production Facilities.* As of the inspection date, the facilities met the requirements for production by

Central Mixing with Automatic Batching and Recordings of Cementitious Materials, Aggregate, Water, and Chemical Admixtures

ROBERT G. SHOGREN STATE OF WASHINGTON 11418 REGISTERED PROFESSIONAL ENGINEER (Seal)

Signature of Licensed Professional Engineer

August 18, 2020	***October 17, 2022***
Inspection Date	Certification Expiration Date

This company will maintain these facilities in compliance with the *Check List* requirements and will correct promptly any deficiencies which develop.

Signature of Company Official

Vice President

Title of Company Official

NOTICE: The Check List indicates only that plant facilities are satisfactory for the production of concrete when properly operated. Conformance of the concrete itself with specification requirements must be verified by usual inspection methods in accordance with sales agreements.

This certificate is issued by the National Ready Mixed Concrete Association on verification that the production facility conforms to the requirements of the NRMCA Certification of Ready Mixed Concrete Production Facilities, QC3. Unauthorized reproduction or misuse of this certificate may result in legal action.

Plant ID #: 801273

Certification ID #: 26403

National Ready Mixed Concrete Association

NRMCA

Certificate of Conformance For Concrete Production Facilities

THIS IS TO CERTIFY THAT

Houser Plant, Renton, WA

Stoneway Concrete

has been inspected by the undersigned licensed professional engineer for conformance with the requirements of the *Check List for Ready Mixed Concrete Production Facilities.* As of the inspection date, the facilities met the requirements for production by

Central Mixing with Automatic Batching and Recordings of Cementitious Materials, Aggregate, Water, and Chemical Admixtures

ROBERT G. SHOGREN STATE OF WASHINGTON 41418 REGISTERED PROFESSIONAL ENGINEER Seal

Signature of Licensed Professional Engineer

August 18, 2020	***October 17, 2022***
Inspection Date	Certification Expiration Date

This company will maintain these facilities in compliance with the *Check List* requirements and will correct promptly any deficiencies which develop.

David A. Alston — Signature of Company Official

Vice President — Title of Company Official

NOTICE: The Check List indicates only that plant facilities are satisfactory for the production of concrete when properly operated. Conformance of the concrete itself with specification requirements must be verified by usual inspection methods in accordance with sales agreements.

This certificate is issued by the National Ready Mixed Concrete Association on verification that the production facility conforms to the requirements of the NRMCA Certification of Ready Mixed Concrete Production Facilities, QC3. Unauthorized reproduction or misuse of this certificate may result in legal action.

Plant ID #: 802812

Certification ID #: 26402

National Ready Mixed Concrete Association

NRMCA

Certificate of Conformance For Concrete Production Facilities

THIS IS TO CERTIFY THAT

Black River Plant, Renton, WA

Stoneway Concrete

has been inspected by the undersigned licensed professional engineer for conformance with the requirements of the *Check List for Ready Mixed Concrete Production Facilities.* As of the inspection date, the facilities met the requirements for production by

Central Mixing with Automatic Batching and Recordings of Cementitious Materials, Aggregate, Water, and Chemical Admixtures

ROBERT G. SHOGREN STATE OF WASHINGTON REGISTERED PROFESSIONAL ENGINEER (Seal)

Signature of Licensed Professional Engineer

October 17, 2019	***December 23, 2021***
Inspection Date	Certification Expiration Date

This company will maintain these facilities in compliance with the *Check List* requirements and will correct promptly any deficiencies which develop.

David A Alston	Vice President
Signature of Company Official	Title of Company Official

NOTICE: The Check List indicates only that plant facilities are satisfactory for the production of concrete when properly operated. Conformance of the concrete itself with specification requirements must be verified by usual inspection methods in accordance with sales agreements.

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Plant ID #: 815484

Certification ID #: 25157

Washington State Department of Transportation

Qualified Product List

Product Information

Manufacturer : Ash Grove Cement Company, Seattle - WA

Product Name : Type IL(X) Blended Hydraulic Cement

Standard Spec : 9-01.2(1)B, Concrete - Blended Hydraulic Cement

Product Description : Blended Hydraulic Cement Type IL(X), Manufactured by Ash Grove Cement Co. - Seattle Plant, Seattle WA. Per WSDOT Standard Specification 9-01.2(1)B, the value of (X) shall be a minimum of 5% and a maximum of 15%.
Product Restriction :

Acceptance Code : 2525
Code Description : Acceptance based upon the cement Manufacturer's Mill Test Report number being shown on each concrete producer's certificate of compliance.

Last Updated : Jan 29, 2021

Contractors with WSDOT Click here for Contractor Product Info Page

STONEWAY CONCRETE

February 11, 2021

RE: ASTM C595 IL (X) Cement

To whom it may concern:

This letter is to clarify Cement type IL(X) for Ashgrove cement, Currently with changing markets pushing to lower global warming potential numbers (GWP), The content for limestone is fluctuating during production, The goal is to reach the 15% limit to maximize c02 reduction. Limestone contents will remain within the spec limits for the duration of the project at 5-15% If any question of content is raised please refer to the most current production MillCert. At the time of this letter content has been raised from 10% to 13%

Please contact me if additional information is required at (206)786-8139

Sincerely,
STONEWAY CONCRETE

Adam Gaunt
Concrete Technical Services

Accounting 9125 10th Avenue South, Seattle, WA 98108 **206.762.2566 Fax 206.763.4178**
Sales 9216 8th Ave South, Seattle, WA 98108 **425.226.1000 Fax 425.228.4924**

ASH GROVE CEMENT COMPANY

"WESTERN REGION"
11811 N.E. First Street, Suite A310
Bellevue, WA 98005
Sales Office: (425) 688-0110
Toll Free: 1-800-665-4382
Fax: (425) 688-0122

January 11, 2021

Greg McKinnon
Stoneway Concrete
9216 8th Ave. S.
Seattle, WA 98108

Dear Greg:

This letter is issued to certify that the cement we supply for your use is in conformance with the requirements of ASTM C-150 for Type I, II and III cement. We also certify that our Type IL cement meets the requirements of ASTM C595 and AASHTO M240 for Blended Hydraulic Cements. We further certify that our cement meets the requirements of the Washington DOT specification, FAA, Corp. of Engineers, and AASHTO M-85.

Attached you will find our Mill Analysis. We further certify that this cement meets all the requirements of the "Buy America Act."

If you should have any questions regarding the use of our product, please feel free to contact the undersigned.

Sincerely yours,

Dave Burg
Technical Services Manager

Attachment

Mill Test Report

Plant Seattle **Cement Type** IL(13) - Portland Limestone Cement **Date** 5-Jan-21
Production Period November 1, 2020 - December 1, 2020 **Certification No.** IL 2020-9

STANDARD REQUIREMENTS
ASTM C 595 Tables 1, 2 and 3

CHEMICAL

Item	Spec. Limit	Test Result
SiO2 (%)	[A]	17.8
Al2O3 (%)	[A]	4.3
Fe2O3 (%)	[A]	3.1
CaO (%)	[A]	63.9
MgO (%)	[A]	0.8
SO3 (%)[D]	3.0 max	2.7
Ignition loss (%)	10.0 max	6.2
Na2O (%)	[A]	0.22
K2O (%)	[A]	0.32
Insoluble residue (%)	[A]	0.41
CO2 (%)	[A]	5.2
Limestone (%)	>5 and ≤15	12.3
CaCO3 in limestone (%)	70 min	97

Potential phase composition (%)[C]		
C3S	[A]	57
C2S	[A]	8
C3A	[A]	6
C4AF	[A]	9

Item	Test Result
Equivalent alkalies (%)	0.43

PHYSICAL

Item		Spec. Limit	Test Result
Air content of mortar (volume %)		12 max	4
Blaine fineness (m^2/kg)		[A]	495
% Passing 325 mesh		[A]	97.9
Autoclave expansion (%)		-0.20 to 0.80	0.06
Compressive strength MPa (PSI)		min:	
	1 Day	[A]	19.9 (2880)
	3 Days	13.0	33.2 (4820)
	7 Days	20.0	38.3 (5560)
	28 Days	25.0	43.2 (6270)[B]
Time of setting (minutes)			
Vicat	Initial not less than	45	105
	Final not more than	420	182
C1038 mortar bar expansion (%)		[E]	0.003[F]
Sulfate resistance, C1012 6-month exp (%)		0.10 max	0.09[F]
Cement Density (g/cm^3)		[A]	3.07[B]

Meets ASTM C1157 Type MS

[A]Not applicable.
[B]Test result represents most recent value.
[C]Adjusted per C150 A1.6.
[D]It is permissible to exceed the max SO3 provided the cement does not develop expansion exceeding 0.020% at 14 days by Method C1038.
[E]Required only if percent SO3 exceeds the limit in Table 1, in which case the Test Method C1038 expansion shall not exceed 0.020% at 14 days.
[F]Test result for this production period not available. Most recent test result provided.

We certify that the above described cement, at the time of shipment, meets the chemical and physical requirements of the ASTM C595/C595M-19 specification.

Signature: _____ Title: Chief Chemist

Edward C. Rafacz

3801 E Marginal Way S, Seattle, WA 98134; Ph: (206) 623-5596; Fax: (206) 623-5355

Washington State Department of Transportation

Qualified Product List

Product Information

Manufacturer : Lafarge North America, Richmond - BC

Product Name : Type IL(X) Blended Hydraulic Cement

Standard Spec : 9-01.2(1)B, Concrete - Blended Hydraulic Cement

Product Description : (AASHTO M240, ASTM C595) Blended hydraulic cement type IL(X): Manufactured in Richmond, British Columbia. Distributed from Seattle, WA. Per WSDOT Standard Specification 9-01.2(4), the value of (X) shall be a minimum of 5% and a maximum of 15%
Product Restriction :

Acceptance Code : 2525
Code Description : Acceptance based upon the cement Manufacturer's Mill Test Report number being shown on each concrete producer's certificate of compliance.

Last Updated : Feb 3, 2016

Contractors with WSDOT Click here for Contractor Product Info Page

LAFARGE
NORTH AMERICA

Cement

January 2021

Dear Sirs,

RE: **Lafarge Cements Certificate of Compliance (2021)**

This is to certify that the Lafarge cements produced at Richmond BC and Exshaw AB Plants comply with ASTM C-150 and AASHTO M-95 for Types I, II, III and V. The Type IT(LX)(SX) cement produced at Seattle, WA comply with ASTM C-595 and AASHTO M-240 specifications. The Type IL(X) cement produced in Richmond BC and Exshaw AB comply with ASTM C-595 and AASHTO M-240 specifications.

NewCem (ground granulated blast furnace slag) meets ASTM C-989 and AASTHO M-302 specifications.

Centralia, Sundance fly ash and Kamloops Class N Pumice meet the specifications of ASTM C-618 and AASHTO M-295.

Should you have any questions, please feel free to call me.

Sincerely,

Rob Shogren, PE, Ph.D.
Technical Service Engineer
Lafarge North America
(206)-923-9953

Cement Mill Test Report

Month of Issue: JANUARY 2021

Plant:	**Richmond, British Columbia**
Product:	**Portland Cement Type IL(15) MS**
Mill Test Report #	**R-TIL-21-01**
Manufactured:	**DECEMBER 2020**

ASTM C595 - 20 Standard Requirements

CHEMICAL ANALYSIS

Item	Spec limit	Test Result
Rapid Method, X-Ray (C 114)		
SiO2 (%)	---	19.4
Al2O3 (%)	---	4.7
Fe2O3 (%)	---	3.1
CaO (%)	---	63.0
MgO (%)	---	0.9
SO3 (%)	3.0 max*	2.8
Loss on ignition @ 950 (%)	10.0 max	5.1
NaEq (Alkali) (%)	---	0.52
Insoluble residue (%)	---	---
Adjusted Potential Phase Composition***		
C3S (%)	---	45
C2S (%)	---	21
C3A (%)	---	7
C4AF (%)	---	9
Sulphate Resistance C1012 (Q4/2019)		0.045

PHYSICAL ANALYSIS

Item	Spec limit	Test Result	
Air content of mortar (%) (C 185)	12 max	5.3	
Blaine Fineness (m2/kg) (C 204)	---	484	
Passing 325 (%) (C 430)	---	98.6	
Autoclave expansion (%) (C 151)	[-0.2 - 0.8]	0.03	
Compressive strength (Mpa [PSI]) (C 109)			
		Mpa	PSI
3 days	13.0 [1890] min	30.7	4450
7 days	20.0 [2900] min	36.6	5310
28 days (Reflects previous month's data)	25.0 [3620] min	44.9	6510
Time of setting (minutes)			
Vicat Initial (C 191)	45-420	94	
Mortar Bar Expansion (C 1038)*			
14 days, % max	0.020 max	0.002	
Cement Density (C186)		3.09	

* May exceed 3.0% SO3 maximum based on our C 1038 results of <0.02% expansion at 14 days.

*** Corrected by using ASTM Calculation for Limestone Cement

Cement meets ASTM C 1157 Type MS

We certify that the above described cement, at the time of shipment, meets the chemical and physical requirements of:
ASTM C 595-20 & AASHTO M 240-20 STANDARD SPECIFICATIONS FOR TYPE IL(15), TYPE IL(15) MS CEMENT

Cement complies with NSF 61

Certified By:

Western BU - Richmond
7611 No 9 Rd Richmond, BC
604 244 4300

Questions or enquiries can be directed to Rob Shogren
Rob Shogren, PhD
Lafarge - Technical Director
5400 W Marginal Way SW, Seattle WA
P +1 206 923 9953
E Rob.Shogren@lafargeholcim.com

Harold Ptachyk B.Sc., PChem
Quality Manager
1/4/2021

Washington State Department of Transportation

Qualified Product List

Product Information

Manufacturer : Lafarge North America, Seattle - WA

Product Name : NewCem

Standard Spec : 9-23.10, Concrete Admix - Ground Granulated Blast Furnace Slag

Product Description : Ground granulated blast furnace slag: Manufactured - Lafarge North America, Seattle, WA; Distributed from Seattle, WA, Pasco, WA, Spokane, WA, and Vancouver, WA. The primary raw materials are originated in Japan.
Product Restriction :

Acceptance Code : 2530
Code Description : Acceptance shall be by receipt of a Manufacturer's Mill Test Report submitted with the concrete mix design.

Last Updated : Jan 16, 2018

Contractors with WSDOT Click here for Contractor Product Info Page

Cement Test Report

Mill Test Report Number: SEA_NEWCEM_OCTOBER20
YEAR: 2020
MONTH: SEPTEMBER
PLANT: Seattle
CEMENT TYPE: NewCem Grade 100

Reference Cement

Fineness by Air Permeability (m^2/kg; ASTM C204)	419	
Fineness by 45 µm (No. 325) Sieve (% retain; ASTM C430)	2.6	
Compressive Strength (ASTM C109/C109 M)	**psi**	**Min Limit**
7-day	5,020	-
28-day	6,260	5,000
	Actual	**Limits**
Total Alkalies (Na_2O + 0.658 K_2O) (%, ASTM C114)	0.84	0.6-0.9

Slag

CHEMICAL ANALYSIS	**Percent**
Silica Dioxide (SiO_2; ASTM C114)	32.8
Ferric Oxide (Fe_2O_3; ASTM C114)	1.4
Aluminum Oxide (Al_2O_3; ASTM C114)	13.3
Calcium Oxide (CaO; ASTM C114)	43.5
Sulfur Trioxide (SO_3; ASTM C114)	2.8
Magnesium Oxide (MgO; ASTM C114)	4.5
Potassium Oxide (K_2O; ASTM C114)	0.25
Titanium Oxide (TiO_2, ASTM C114)	0.62
Loss on Ignition (L.O.I.; ASTM C114)	1.75
Total Alkalies	0.44
Inorganic Process Addition	6

Slag

Fineness by Air Permeability (m^2/kg; ASTM C204)	519		
Fineness by 45 µm (No. 325) Sieve (% retain; ASTM C430)	4.5		
Compressive Strength (ASTM C109/C109 M)	**psi [Mpa]**	**SAI**	**SAI Limit Min**
28-day (Previous Month)	6260 [43.2]	104	95
Specific Gravity (Mg/m^3; ASTM C188)	2.87		
	Actual		**Max Limit**
Air Content of Mortar (%, ASTM C185)	5		12
Sulfide Sulfur (% S, ASTM C114)	0.8		2.5
Sulfate Ion (% as SO3, ASTM C114)	0.8		[A]
Autoclave expansion (%, CSA A3004-B5)	0.001		0.5
Color Value L*	77.4		

[A] Not Applicable.

The ground granulated blast furnace slag complies with the current specification of the chemical physical requirement of ASTM C-989, AASHTO M-302 for grade 100 Ground Granulated Blast Furace Slag (GGBFS) and and CSA A3001 Slag.
Slag source is JFE Mineral Company in Kurashiki City, Japan. NewCem is ground and manufactured in Seattle, WA.

NSF Certified to NSF/ANSI 61

Certified by:

Daniel Waldron
Quality Control Laboratory Supervisor
October 15, 2020

WSDOT MATERIALS LAB 01/21/2021

Aggregate Source Approval Report

Owner: Glacier Northwest
Lessee:
Located in: A part of Section 22 and 23 Section 23 T19N R1E

Aggregate Source: PS-B-335
Known as: DuPont Pit
County: Pierce

Remarks:

Mineral Agg. and Surfacing: Test Date: 02/25/2020 Expiration Date: 02/25/2025

Absorption: 0.75	Apparent Sp. G.: 2.778	Bulk Sp. G. (SSD): 2.741	Bulk Sp. G.: 2.721
Deg: 76	LA: 12		

Remarks:

Currently approved as a source of aggregate for:

ATB	Ballast	BST Crushed Cover Stone
BST Crushed Screenings	Crushed Surfacing Base Course	Crushed Surfacing Key Stone
Crushed Surfacing Top Course	Gravel Backfill for Foundation Class A	HMA Other Courses
HMA Wearing Course	Maintenance Rock	Permeable Ballast

Acceptance tests need to be performed as necessary.

Aggregates for Concrete: Test Date: 03/09/2020 Expiration Date: 03/09/2025

ASR - 14 Day :	ASR - One Year: 0.031	CCA Absorption: 0.82	CCA Sp.G: 2.701
Deg: 61	FCA Absorption: 1.48	FCA Organics: 1	FCA Sp. G: 2.668
LA: 11			

Remarks: 1-Year ASR Results Expire 02/01/2022

Currently approved for:

Coarse Concrete Aggregates

Fine Concrete Aggregates

Acceptance tests need to be performed as necessary Acceptance tests need to be performed as necessary

Riprap, Quarry Spalls, Rock for Rock Wall, Erosion and Scour Protection: Test Date: Expiration Date:

Absorption:	Apparent Sp. G.:	Bulk Sp. G. (SSD):	Bulk Sp. G.:
Deg:	LA:		

Remarks:

NOT Approved for:

Quarry Spalls	Riprap	Rock for Erosion and Scour Protection
Rock for Rock Walls	Stone 9-27.3(6)	

Streambed Aggregates: Test Date: 02/25/2020 Expiration Date: 02/25/2025

Absorption: 0.75	Apparent Sp. G.: 2.778	Bulk Sp. G. (SSD): 2.741	Bulk Sp. G.: 2.721
Deg: 76	LA: 12		

Remarks:

Currently Approved for:

Streambed Aggregate

Gravel Borrow for Structural Earth Walls: Test Date: 02/25/2020 Expiration Date: 02/25/2025

Bulk Sp. G. (SSD): 2.741	Deg: 76	LA: 12

Remarks: For geosynthetic reinforcement, the gravel borrow shall be tested for pH prior to placement. For metallic reinforcement, the gravel borrow shall be tested for pH, resistivity, chlorides, and sulfates prior to placement. If the resistivity of the backfill material equals or exceeds 5,000 ohm-cm, the specified chloride and sulfate limits may be waived. If the aggregate source has variable quality, additional testing may be required. Contact the Regional Materials Engineer or the State Geotechnical Engineer for direction.

Currently Approved for:

Gravel Borrow for Str Earth Walls

ALL OTHER PIT RUN MATERIALS:

Project Engineer may request preliminary samples but Aggregate Source Approval is not required.

AGGREGATE MATERIALS NOT REQUIRING ASA APPROVAL :

Aggregate for Gravel Base 9-03.10
Gravel Backfill for Foundation Class B 9-03.12(1)B
Gravel Backfill for Walls 9-03.12(2)
Gravel Backfill for Pipe Zone Bedding 9-03.12(3)
Gravel Backfill for Drains 9-03.12(4)
Gravel Backfill for Drywells 9-03.12(5)
Backfill for Sand Drains 9-03.13
Sand Drainage Blanket 9-03.13(1)
Gravel Borrow 9-03.14(1)
Select Borrow 9-03.14(2)

Common Borrow 9-03.14(3)
Native Material for Trench Backfill 9-03.15
Foundation Material Class A and B 9-03.17
Foundation Material Class C 9-03.18
Bank Run Gravel for Trench Backfill 9-03.19
Commercial Concrete Aggregate 6-02.3(2)B

WSDOT MATERIALS LAB

01/21/2021

Aggregate Source Approval Report

Owner: Quality Aggregates LLC
Lessee:
Located in: NW 1/4 SE 1/4 Section 33 T23N R6E

Aggregate Source: PS-A-458
Known as: Lake Francis Pit
County: King

Remarks:

Mineral Agg. and Surfacing: Test Date: 08/11/2016 Expiration Date: 08/11/2021

Absorption: 0.97	Apparent Sp. G.: 2.758	Bulk Sp. G. (SSD): 2.712	Bulk Sp. G.: 2.686
Deg: 76	LA: 17		

Remarks:

Currently approved as a source of aggregate for:

ATB	Ballast	BST Crushed Cover Stone
BST Crushed Screenings	Crushed Surfacing Base Course	Crushed Surfacing Key Stone
Crushed Surfacing Top Course	Gravel Backfill for Foundation Class A	HMA Other Courses
HMA Wearing Course	Maintenance Rock	Permeable Ballast

Acceptance tests need to be performed as necessary.

Aggregates for Concrete: Test Date: 08/25/2016 Expiration Date: 08/25/2021

ASR - 14 Day : 0.46	ASR - One Year: 0.03	CCA Absorption: 0.69	CCA Sp.G: 2.734
Deg: 77	FCA Absorption: 1.65	FCA Organics: 2	FCA Sp. G: 2.669
LA: 14			

Remarks: 1-Year ASR results expire 04/19/2023

Currently approved for:

Coarse Concrete Aggregates

Fine Concrete Aggregates

Acceptance tests need to be performed as necessary Acceptance tests need to be performed as necessary

Riprap, Quarry Spalls, Rock for Rock Wall, Erosion and Scour Protection: Test Date: Expiration Date:

Absorption:	Apparent Sp. G.:	Bulk Sp. G. (SSD):	Bulk Sp. G.:
Deg:	LA:		

Remarks:

NOT Approved for:

Quarry Spalls	Riprap	Rock for Erosion and Scour Protection
Rock for Rock Walls	Stone 9-27.3(6)	

Streambed Aggregates: Test Date: 08/25/2016 Expiration Date: 08/25/2021

Absorption: 0.69	Apparent Sp. G.: 2.767	Bulk Sp. G. (SSD): 2.734	Bulk Sp. G.: 2.715
Deg: 77	LA: 14		

Remarks:

Currently Approved for:

Streambed Aggregate

Gravel Borrow for Structural Earth Walls: Test Date: 08/25/2016 Expiration Date: 08/25/2021

Bulk Sp. G. (SSD): 2.734	Deg: 77	LA: 14

Remarks: For geosynthetic reinforcement, the gravel borrow shall be tested for pH prior to placement. For metallic reinforcement, the gravel borrow shall be tested for pH, resistivity, chlorides, and sulfates prior to placement. If the resistivity of the backfill material equals or exceeds 5,000 ohm-cm, the specified chloride and sulfate limits may be waived. If the aggregate source has variable quality, additional testing may be required. Contact the Regional Materials Engineer or the State Geotechnical Engineer for direction.

Currently Approved for:

Gravel Borrow for Str Earth Walls

ALL OTHER PIT RUN MATERIALS:

Project Engineer may request preliminary samples but Aggregate Source Approval is not required.

AGGREGATE MATERIALS NOT REQUIRING ASA APPROVAL :

Aggregate for Gravel Base 9-03.10
Gravel Backfill for Foundation Class B 9-03.12(1)B
Gravel Backfill for Walls 9-03.12(2)
Gravel Backfill for Pipe Zone Bedding 9-03.12(3)
Gravel Backfill for Drains 9-03.12(4)
Gravel Backfill for Drywells 9-03.12(5)
Backfill for Sand Drains 9-03.13
Sand Drainage Blanket 9-03.13(1)
Gravel Borrow 9-03.14(1)
Select Borrow 9-03.14(2)

Common Borrow 9-03.14(3)
Native Material for Trench Backfill 9-03.15
Foundation Material Class A and B 9-03.17
Foundation Material Class C 9-03.18
Bank Run Gravel for Trench Backfill 9-03.19
Commercial Concrete Aggregate 6-02.3(2)B

Washington State Department of Transportation

Qualified Product List

Product Information

Manufacturer : GCP Applied Technologies - Formerly W.R. Grace and Company, Vancouver - BC

Product Name : Recover

Standard Spec : 9-23.6(5), Concrete Admixture - Type D - Water-Reducing and Retarding Admixtures

Product Description : Liquid water reducing/set retarding admixture for concrete: Type D
Product Restriction :

Acceptance Code : 2250
Code Description : Acceptance is by field verification and the retaining of the Concrete Producer's Certificate of Compliance indicating the product and dosage of the admixture conform to the concrete mix design.

Last Updated : Aug 20, 2019

Contractors with WSDOT Click here for Contractor Product Info Page

RECOVER®

Hydration stabilizer ASTM C494 Type B and D

Product Description

RECOVER® is a ready-to-use aqueous solution of chemical compounds specifically designed to stabilize the hydration of Portland cement concretes. The ingredients are factory pre-mixed in exact proportions under strict quality control to provide uniform results. One gallon weighs approximately 9.6 lbs (1.15 kg/L).

Product Advantages

- Eliminates the need to discharge wash water from the mixer
- Prevents the waste of unused concrete
- Provides predictable extended set for continuous placement on mass concrete and tremie projects, or on long hauls to remote sites

Uses

RECOVER® is used to stabilize mixer wash water and returned or leftover concrete for extended periods, allowing for use of the materials when specified or allowed. It is also used where controlled extended set of concrete is needed. It is the concrete user's responsibility to determine if leftover, returned or extended-set concrete is specified or allowed.

Wash Water

For wash water applications, RECOVER ® is used to eliminate the need to discharge wash water from the mixer. This allows the wash water to be used as mix water in the next batch of concrete produced and prevents the residual plastic concrete from hardening. Stabilization of up to 96 hours is possible depending on dosage rate.

Returned Concrete

For returned or leftover concrete, RECOVER ® is used to prevent plastic concrete from reaching initial set. This allows the concrete to be stored in a plastic state and then used when specified or allowed. The use of this concrete may require the addition of freshly batched concrete and/or an accelerator such as DARACCEL ® or POLARSET® .

Stabilization of concrete for up to 96 hours is possible depending on dosage rate. Use prevents the waste of unused concrete.

Set Time Control

RECOVER® is also used in situations where a controlled set time extension is required. Examples include: extended hauls, large continuous pours or pre-batching of concrete for later use.

Addition Rates

Addition rates of RECOVER ® for wash water range from 6 to 128 fl oz (180 to 3800 mL) per treatment. The amount used will depend on the specific materials involved, mixer type and stabilization period. Addition rates for returned or leftover concrete will range from 3 to 128 fl oz/100 lbs (195 to 8350 mL/100 kg) of cement. The amount used will depend on the specific materials involved, concrete age, temperature conditions and stabilization period. For applications requiring set time extensions well in excess of 4 hours, RECOVER® may be used at addition ranges from 5 to 50 oz/100 lbs (325 to 3260 mL/100 kg) of cement. For use as a traditional ASTM Type B or D retarder, RECOVER® may be used at addition rates of 2 to 6 oz/100 lbs (130 to 390 mL /100 kg) of cement. Proper dosage rate selection can only be achieved through pretesting. Consult your local GCP Applied Technologies admixture representative.

Compatibility with Other Admixtures and Batch Sequencing

RECOVER® is compatible with most GCP admixtures as long as it is added separately to the concrete mix, usually through the water holding tank discharge line. In general, it is recommended that RECOVER® be added to the concrete mix near the end of the batch sequence for optimum performance. Different sequencing may be used if local testing shows better performance. Please see GCP Technical Bulletin TB-0110, *Admixture Dispenser Discharge Line Location and Sequencing for Concrete Batching Operations* for further recommendations.

Pretesting of the concrete mix should be performed before use, as conditions and materials change in order to ensure compatibility, and to optimize dosage rates, addition times in the batch sequencing and concrete performance. For concrete that requires air entrainment, the use of an ASTM C260 air entraining agent (such as Daravair® or Darex® product lines) is recommended to provide suitable air void parameters for freeze-thaw resistance. Please consult your GCP Applied Technologies representative for guidance.

Packaging & Handling

RECOVER® is available in bulk, delivered by metered tank trucks, totes and drums.

RECOVER® will freeze, but will return to full effectiveness after thawing and thorough mechanical agitation.

Performance

RECOVER® stabilizes the hydration process of Portland cement preventing it from reaching initial set. This stabilization is not permanent and is controlled by dosage rate. For wash water, the RECOVER® treated water is mixed or sprayed in a specific manner to thoroughly coat the interior of the mixer. The water is used as mix water in the next batch of concrete produced, which then scours the unhardened material from the interior of the mixer. Stabilization of returned or leftover concrete with RECOVER® maintains the plasticity of the concrete for the desired storage duration. This stabilized concrete then resumes normal hydration when the RECOVER® dosage effects subside, or when it is activated by the addition of fresh concrete and/or an accelerator. The result can be concrete with normal plastic and hardened properties.

Dispensing Equipment

A complete line of GCP dispensing equipment is available for RECOVER ® . This includes the Reach 360TM System which uses an innovative spray wand technology to simplify wash water procedures.

GCP Applied Technologies Inc., 62 Whittemore Avenue, Cambridge, MA 02140 USA.

In Canada, 294 Clements Road, West, Ajax, Ontario, Canada L1S 3C6.

This document is only current as of the last updated date stated below and is valid only for use in the United States. It is important that you always refer to the currently available information at the URL below to provide the most current product information at the time of use. Additional literature such as Contractor Manuals, Technical Bulletins, Detail Drawings and detailing recommendations and other relevant documents are also available on www.gcpat.com. Information found on other websites must not be relied upon, as they may not be up-to-date or applicable to the conditions in your location and we do not accept any responsibility for their content. If there are any conflicts or if you need more information, please contact GCP Customer Service.

Last Updated: 2018-08-24

gcpat.com/solutions/products/recover

Washington State Department of Transportation

Qualified Product List

Product Information

Manufacturer : GCP Applied Technologies - Formerly W.R. Grace and Company, Vancouver - BC

Product Name : Zyla 630

Standard Spec : 9-23.6(2), Concrete Admixture - Type A - Water-Reducing Admixtures

Product Description : Liquid normal range water reducing admixture for concrete: Type A
Product Restriction :

Acceptance Code : 2250
Code Description : Acceptance is by field verification and the retaining of the Concrete Producer's Certificate of Compliance indicating the product and dosage of the admixture conform to the concrete mix design.

Last Updated : Aug 20, 2019

Contractors with WSDOT Click here for Contractor Product Info Page

ZYLA® 630

Water-reducing admixture -- ASTM C494 Type A and D

Product Description

ZYLA® 630 water-reducing admixture is a proprietary formulation incorporating highly purified specialty organic chemicals. ZYLA® 630 promotes more complete hydration of Portland cement and has no effect on concrete air entrainment.

The ZYLA® product line of water reducers is specially formulated to have a synergistic effect with polycarboxylate-based mid-range and high-range water reducers that improve flat-work finishability. This product contains no intentionally added chloride and as such is essentially chloride free. It is manufactured under rigid controls that provide uniform, predictable performance. ZYLA® 630 is supplied as a light brown, low viscosity liquid, and is ready-to-use as received. One gallon weighs approximately 9.1 lbs (1.1 kg/L).

Product Advantages

- No impact on concrete air content
- Better control of water reduction and setting times as compared to traditional lignin-based water reducers
- Synergistic performance of polycarboxylate-based mid-range and high-range water reducers, which includes water reduction, concrete strength and air control
- In the hardened state, improves the compressive and flexural strengths at all ages of concrete versus traditional lignin-based water reducers

Uses

ZYLA® 630 is used to produce concrete mixes with lower water content (typically 3% to 10% reduction), greater plasticity and higher compressive strengths. ZYLA® 630 is suitable for normal weight and light weight concrete in ready-mix, precast and prestressed applications.

Finishability

The unique chemistry of ZYLA ® 630 positively impacts the finishability of concrete by providing a creamier and more homogenous texture, with more uniform bleed rate relative to traditional lignin-based water reducers. The influence of ZYLA® 630 on the finishability of lean mixes has been particularly noticeable. Floating and troweling, by machine or hand, imparts a smooth, close tolerance surface.

Addition Rates

The addition rate range of 3 to 5 fl oz/100 lbs (195 to 325 mL/ 100 kg) of cement or cementitious is typical for most applications. However addition rates of 2 to 7 fl oz/100 lbs (130 to 455 mL/100 kg) of cement or cementitious may be used if local testing shows acceptable performance. Pretesting is required to determine the appropriate addition rate for desired performance. The optimum addition rate depends on the other concrete mixture components, job conditions, and desired performance characteristics.

Compatibility with Other Admixtures and Batch Sequencing

ZYLA® 630 is compatible with most GCP admixtures as long as they are added separately to the concrete mix, usually through the water holding tank discharge line. In general, it is recommended that ZYLA® 630 be added to the concrete mix near the end of the batch sequence for optimum performance. Different sequencing may be used if local testing shows better performance. Please see GCP Technical Bulletin TB-0110, *Admixture Dispenser Discharge Line Location and Sequencing for Concrete Batching Operations* for further recommendations.

Pretesting of the concrete mix should be performed before use, as conditions and materials change in order to assure compatibility, and to optimize dosage rates, addition times in the batch sequencing and concrete performance. For concrete that requires air entrainment, the use of an ASTM C260 air-entraining agent (such as DARAVAIR® or DAREX® product lines) is recommended to provide suitable air void parameters for freeze-thaw resistance. Please consult your GCP Applied Technologies representative for guidance.

Packaging & Handling

ZYLA® 630 is available in bulk, delivered by metered tank trucks, in totes, and in drums.

ZYLA® 630 will freeze at about 28°F (-2°C), but will be completely uniform after thawing and thorough agitation.

Dispensing Equipment

A complete line of accurate, automatic dispensing equipment is available. ZYLA ® 630 may be introduced to the mix through the water holding tank discharge line. The ZYLA® product line is formulated to be free of sediment.

Specifications

Concrete shall be designed in accordance with *Standard Recommended Practice for Selecting Proportions for Concrete*, ACI 211.

The water-reducing admixture shall be ZYLA ® 630, as manufactured by GCP Applied Technologies, or equal. The admixture shall not contain calcium chloride as a functional ingredient. ZYLA® 630 will not promote corrosion of reinforcing steel embedded in concrete. It shall be used in strict accordance with the manufacturers' recommendations. The admixture shall comply with ASTM Designation C494, Type A and D water-reducing admixtures. Certification of compliance shall be made available on request.

The admixture shall be delivered as a ready-to-use liquid product and shall require no mixing at the batching plant or job site.

I-405 / Renton to Bellevue Widening and Express Toll Lanes Project Design Build Project
Review Comment Summary and Resolution Form

Package Description: RAM0171 Stoneway Conc Mix Design CL4KP 5K						Submittal Date: 2/4/2021		
Reviewer(s): Nancy Guinn / WSDOT						Comment Due Date: 2/9/2021		
Comment No.	By	Sheet No. *	Review Comment	Initial Code **	Response	Response By	Final Code ***	Correction Verified by
Code: A=Accept Comment; B=Review and Discuss Comment; C=Evaluated but Not Incorporated; D=Comment Beyond Scope or Beyond Design Phase								
Note: * Indicates Sheet No., Page No. and Line No. or "G" for General Comment; ** Filled out by Design; *** Agreed Resolution (code "B" is not acceptable)								
1	NG	RAM Page 1 and MD CL4KP from Seattle Plant 11	Fourth Material Item: Ashgrove Cement Type IL(**10**) - MD CL4KP from Seattle notes Ashgrove Cement Type IL(**10**) but the MTR attached to submittal is for Ashgrove Cement Type IL(**13**) - need MTR for Ashgrove Cement Type IL(10) or change RAM and Mix Design to Type IL(13)	A	RAM cover sheet and mix design form have been updated to say Ashgrove Cement Type IL(X). X fluctuates within the WSDOT Standard Specification allowable 5-15%. A letter from Stoneway has been added to the RAM to clarify variabe limestone content in Ashgrove cement.	IA (Stoneway)		
2	BW	RAM Pg - 17.	I believe this mill test report is intended for test results for the Cement Type IL(10) that is submitted with this RAM, but the mill test report shows that it's for Cement Type IL(13). Needs to be a Mill test report for the Cement Type IL(10).	A	Addressed per comment #1	IA (Stoneway)		
1	NG	RAM Page 1	Fourth Material Item: Under Material delete "Limestone 5-15"					
2	NG	RAM Page 1	Fourth Material Item: Under RAM Approval Code change 2 to 2* and under **Remarks:** add *See attached Stoneway letter dated February 11, 2021 regarding Mill Cert designation for Ashgrove Cement"					

I-405 / Renton to Bellevue Widening and Express Toll Lanes Project Design Build Project
Review Comment Summary and Resolution Form

Package Description: RAM0171 Stoneway Conc Mix Design CL4KP 5K						Submittal Date: 2/4/2021		
Reviewer(s): Nancy Guinn / WSDOT						Comment Due Date: 2/9/2021		
Comment No.	By	Sheet No. *	Review Comment	Initial Code **	Response	Response By	Final Code ***	Correction Verified by
Code: A=Accept Comment; B=Review and Discuss Comment; C=Evaluated but Not Incorporated; D=Comment Beyond Scope or Beyond Design Phase								
Note: * Indicates Sheet No., Page No. and Line No. or "G" for General Comment; ** Filled out by Design; *** Agreed Resolution (code "B" is not acceptable)								
1	NG	RAM Page 1 and MD CL4KP from Seattle Plant 11	Fourth Material Item: Ashgrove Cement Type IL(**10**) - MD CL4KP from Seattle notes Ashgrove Cement Type IL(**10**) but the MTR attached to submittal is for Ashgrove Cement Type IL(**13**) - need MTR for Ashgrove Cement Type IL(10) or change RAM and Mix Design to Type IL(13)					
2	BW	RAM Pg - 17.	I believe this mill test report is intended for test results for the Cement Type IL(10) that is submitted with this RAM, but the mill test report shows that it's for Cement Type IL(13). Needs to be a Mill test report for the Cement Type IL(10).					